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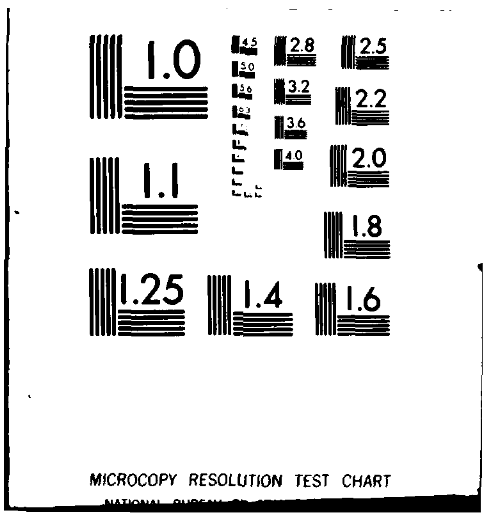
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INTERIM TECHNICAL REPORT TR 80-A-4

INTERNAL AND EXTERNAL CRISIS EARLY WARNING AND MONITORING

By

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Sponsored by

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EXECUTIVE SUMMARY

INTERNATIONAL I&W

Research on the Early Warning and Monitoring System (EWAMS) during FY 1980 is chronicled in this report. The proliferation of quantitative computer-based systems for facilitating I&W (Indications and Warning) analysis has provided a significant impetus for EWAMS research. In addition, extensive evidence from behavioral decision theory indicates that humans are susceptible to various cognitive-perceptual biases and fallacies and that a computer-based tracking and warning system can be of value to intelligence analysts. Basic and applied political, social, and computer science R&D has clearly facilitated the process of designing, testing, and refining EWAMS.

Initial EWAMS research revolved around the testing of quantitative political indicators, the development of general scans, and the selection of a computer base for the system. The various software and research tasks of the first phase of Early Warning and Monitoring Project efforts provided a firm foundation for FY 1980 activities.

A key objective of the recent political research program involved the realm of crisis warning. The discriminant analysis methodology was tested extensively and subsequently

incorporated into the system. The accuracy and efficiency of the methodology were both impressive, leading to a decision to replace the simple extrapolative warning methodology with one based on discriminant function-generated probabilities.

A second focus was the automated I&W module of EWAMS. Automated I&W consists of two components: alerts and directed scans. Alert scans automatically yield information concerning conflict "hotspots" (reports of the major centers of international stress), monitoring alerts (lists of situations which warrant vigilant "watching" by the analyst), and warning alerts (lists of forecasted crises). Directed scans (e.g., historical search), in contrast, maximize flexibility from the perspective of the user of the system and emphasize the importance of the individual analyst's own knowledge, expertise, and wisdom.

Comparative source performance constituted a third research task. Extensive comparisons of NYT (<u>New York Times</u>) and MAG (<u>Manchester Guardian</u>) were undertaken. Overall, the finding has been that MAG and NYT are two separate (albeit somewhat similar) "windows on the world." Although each has regional biases and strengths, the I&W analyst is advised in the typical instance to consult <u>both</u> EWAMS sources; this can be expected to yield a more reliable, valid portrait of reality and minimize both "misses" and "false alarms."

FY 80 software development and refinement activities were extensive in scope and magnitude. Numerous enhancements and cosmetic modifications have been made to EWAMS. The enhancements to the master version of the EWAMS, which is housed at DARPA's DDF (Demonstration and Development Facility), include keyword, SPI (Special Purpose Indicators), CAP (Country Activity Profile scores)--all new features of the analytic component of EWAMS--and automated I&W. The DDF/EWAMS, a minicomputer-based system in FORTRAN, was also converted to the tailored EUCOM/EWAMS, a microprocesser-based system in BASIC.

INTRANATIONAL I&W

Past basic and applied research on intranational stress and crisis has been exhaustively reviewed and assessed. An analytic system relevant to African intranational I&W should feature four primary modules: a data base; indicators; forecasting methodologies; and a computer base. Progress on all four has been achieved, which provides the foundation for continued development and enhancement of the AWAMS.

The prototype AWAMS is discussed in detail. The conceptual blueprint envisions a system which is user-oriented in nature, parallel to the existing EWAMS in design and operation, systematic and comprehensive in scope and depth, and short-term and real-time in focus and nature.

The AWAMS data collection design has been completely developed (including subnational actors and targets and intra-national event categories). The current prototype AWAMS indicators are based on those available to the EWAMS users. Data have been amassed since the beginning of 1980 from three distinct sources: Manchester <u>Guardian</u>/London <u>Times</u>; FBIS (Foreign Broadcast Information Service); and cable traffic. The software base of AWAMS has been designed and programmed.

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LIST OF ABBREVIATIONS

AWAMS:	Africa Warning and Monitoring System
CAP:	Country Activity Profile
CIA:	Central Intelligence Agency
COTR:	Contracting Officer's Technical Representative
CT:	Cybernetics Technology
DARPA:	Defense Advanced Research Projects Agency
DIA:	Defense Intelligence Agency
DDF:	Demonstration and Development Facility
EWAMS:	Early Warning and Monitoring System
EUCOM:	European Command
FBIS:	Foreign Broadcast Information Service
I&W:	Indications and Warning
JCS:	Joint Chiefs of Staff
MAG:	Manchester Guardian
NMIC:	National Military Intelligence Center
NYT:	New York Times
SPI:	Special Purpose Indicators
TOL:	Times of London
WEIS:	World Event Interaction Survey

ACKNOWLEDGMENTS

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CSM/DDF Systems Analyst. Dr. E. Luther Johnson of Courtland International, Ltd. has been an excellent critic and source of feedback. Dr. Stephen J. Andriole, President of International Information Systems, did the pioneering work on the Early Warning and Monitoring System and converted an idea into an operational analytic system. For their very helpful advice, we are indebted to the analysts in the Defense Intelligence Agency (DIA/JSW1) and EUCOM/J2. We would also like to express our gratitude to Michael A. Daniels, Esquire, President of IPPRC, for his support and encouragement.

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Finally, two people deserve special recognition for transforming a manuscript into a technical report: Violet McCarthy and Frances Morris. Without their dedication and professionalism, neither this report nor any of our written research products would ever be produced--or produced as superbly.

The author assumes direct responsibility for any errors of fact or interpretation in this document.

Gerald W. Hopple
Principal Investigator
Early Warning and Monitoring Project

SECTION I

INTERNATIONAL I&W

1.0 INTRODUCTION

Recent research on the Early Warning and Monitoring System (EWAMS) is chronicled in this report. EWAMS, which is sponsored by the Cybernetics Technology Division of the Defense Advanced Research Projects Agency (DARPA/CTD), is being developed and tested at the International Public Policy Research Corporation (IPPRC). The testing is both retrospective and current (real-time) in nature.

The focus of the research summarized in this volume--the dual and interrelated Indications and Warning (I&W) domains of international and intranational affairs monitoring and forecasting--represents the amalgamation of extensive work in computer science, political science, international relations, and social scientific methodology. Considerable progress has occurred in the development and testing of the <u>inter</u>national I&W tracking and warning system; work has recently been launched on a prototype version of an eventual <u>intra</u>national I&W system. Central to these endeavors is the conviction that recent and current R&D in the realms of I&W, quantitative political inquiry, and computer science provides a firm foundation for developing a viable analytic system to aid the U.S. defense intelligence analysis community.

1.1 Background

Two generalizations reinforce the desirability of the research from the vantage point of the I&W thrust. One is the proliferation of quantitative and computer-based systems for facilitating I&W analysis, a trend which is illuminated in Clarkson et al. (1980). The second is the extensive evidence from behavioral decision theory which demonstrates convincingly that, like all human information processers and decision makers, intelligence analysts are susceptible to a number of cognitive biases and fallacies of inference-making and reasoning in general. The experimental psychological and other pertinent literature on cognitive processes, ably summarized by Heuer (1980) and Stech (1979) and reported in a stream of journal articles and books, provides innumerable examples of judgmental heuristics and other tendencies which bias the tasks of information processing and information integration.

1.1.1 Computerized systems. The first trend--the upsurge in computer-based, quantitative intelligence tracking and/or warning systems--is indisputable. What is problematic, however, is a twofold issue: the design, testing, and evaluation of such systems and the adoption and use of the systems by the target user community. The latter problem is particularly vexing; machine technology has quite literally outpaced the human user of computers.

Careful and successful design and testing programs are preludes to and determinants of the adoption of monitoring and warning analysis management systems. The validity and reliability of data bases, indicator systems, and methodologies must be ascertained. In addition, the testing and evaluation processes must take into account the needs, interests, and other characteristics of users.

Transfer of a monitoring and warning analysis management system obviously depends on the willingness of analysts to integrate the system into their repertoires of skills, aids, and approaches. As Clarkson et al. (1980) quite properly point out, one of the basic questions is that of how to aid the human mind in performing the warning analysis task; this issue must be confronted in the context of the realization that both humans and computers have limitations.

Computers can store, process, retrieve, and display vast amounts of data quickly and efficiently; color graphics and other display technologies can be exploited to highlight key phenomena and otherwise assist the analyst. While the information retrieval and analytic capabilities of computers are impressive, machines neither can nor should be substituted for expertise and judgment.

1.1.2 Human constraints. At the same time, while the human analyst can identify the key variables and make ultimate decisions, he or she confronts inevitable cognitive constraints and other limitations. To cite one simple but very apt example, a computer can effortlessly search a data base of 100,000 items for the appearance of a certain pattern (e.g., the number of event/interaction sequences when accuse events preceded force events); the human analyst would have neither the time nor the ability to perform such a routine but often helpful pattern recognition operation. The analyst would simply tend to "recall" a few relevant examples, instances that in the typical case would be neither representative of nor randomly selected from the relevant universe.

The development and refinement of the international I&W system which will be discussed in Section I of this study has reached the point that issues of performance have already arisen and have been dealt with in a preliminary fashion. Like almost all computer-based I&W systems, the testing and evaluation process has not been pursued in terms of a comprehensive, systematic research design. In the context of an explicit warning analysis model and a set of evaluative tools and criteria (see, e.g., Clarkson et al., 1980), further efforts can be undertaken to test, evaluate, and refine the international I&W system; an analogous

approach can also be applied to the more embryonic intranational I&W system which is conceptually fleshed out in Section II.

Central to the successful transfer of an I&W analysis-aiding system is an explicit emphasis on a user-oriented product. This concern has permeated the development of the international I&W system; a genuinely interactive system, computer graphics, ease of use, and simplicity of operation have all been emphasized.

While the computer (software and hardware) base of the system has contributed to its user-oriented nature, it is equally important to demonstrate the validity and utility of the system to the user community. To an extent, of course, this has been the goal of recent and current phases of research; the testing of the data, indicator, and methodology bases of the system has been extensive and painstaking. However, this aspect of the research effort must accelerate and must also undergo a qualitative transformation which incorporates more directly and completely the question of assessing the utility of the system and its relevance to the user community; users will not adopt a system unless it is unequivocally demonstrated to them that it is useful and valid from their perspectives.

Human information processing and cognitive limitations are pervasive in nature and extensive in scope; indirect evidence from social psychology/behavioral decision theory research and from other evaluation and decision contexts and direct evidence from post-mortems and other assessments of intelligence analysis support the validity of this generalization. Intelligence analysts, in other words, are no more exempt from these biases than anyone else who engages in estimation and choice selection activities.

A pervasive consistency tendency affects and often distorts perception and memory. The principle of mental economy favors both simplicity and stability; there is ordinarily a deeply rooted bias against the assimilation of information that would require attitude change. Information integration biases permeate the judgment process; for example, because of judgmental heuristics such as representativeness and availability, people tend to make inferences that are too extreme given the data. Often, people even forget that they did not know something before it happened--the hindsight bias leads to a belief in foresight insights which they actually had only because of outcome knowledge (Stech, 1979).

Computer-based monitoring and warning systems which combine retrospective with current data and indicators will

not be a magic panacea for the array of cognitive-perceptual biases which intrude at the individual and organizational levels of analysis. But such systems may aid the human analyst in a variety of ways and thereby minimize such biases.

For example, the availability heuristic, which entails the tendency to assume that those events are most probable for which the recall of relevant cases is easiest, is a common fallacy. There is also a frequent neglect of base rate data (the distribution of outcomes in similar situations) and an accompanying overemphasis on case data. Salience (the most recent or dramatic case/s) often determines the outcome of interpretation and judgmental processes.

These tendencies pervade international affairs analysis. The overuse of the Munich analogy and the overapplication of the Cuban missile crisis as an exemplar are both illustrations of this syndrome. The League of Nations was a retrospective effort to prevent World War I; the United Nations was similarly an after-the-fact response to the outbreak of World War II; current Soviet-Yugoslav relations are often compared to Soviet-Czech relations in 1968. These and an avalanche of other possible examples all indicate that case data are typically favored over base rate data.

A computer-based warning system can mitigate against this bias by providing the analyst with an historical base against which to compare a current or emerging situation. Like less formal I&W analysis, quantitative monitoring and warning systems are structured around the principles of pattern analysis and the tracking of deviations. How deviant is a particular case? How deviant is the analogous case? What are the statistical patterns in terms of raw scores, deviation scores, frequencies, and probabilities? Quantitative, computer-based I&W systems cannot be expected to eradicate completely the problems and dangers of cognitive-perceptual biases; such systems can, however, minimize the potential scope of such constraints.

1.1.3 R&D progress. Political and social science R&D has also experienced progress; without the foundation provided by earlier basic research on political indicator systems, data bases, and conceptual frameworks, the past EWAMS research on computer-based monitoring and warning would have been impossible.

Quantitative political science and international relations have undergone a dual revolution in the last few decades. The quantitative/methodological thrust is one manifestation of this revolutionary process; statistics and sophisticated methodological strategies have permeated research in international politics and other fields of political science.

The second revolution has been cybernetic in nature; the advent of the large computer has facilitated the storage and analysis of massive data bases and the more recent trend toward the use of micro- and mini-computers encourages off-line/parallel and even on-line applications. With the upsurge in interactive systems, the use of graphics, and other illustrations of user-oriented software, even some "traditionalists" are beginning to recognize the virtues of computers.

A third trend has also emerged. In addition to the proliferation of methodologies and the increased awareness--and appreciation--of an array of developments in computer hardware and software, a renewed concern with applied inquiry is clearly discernible. This is reflected in recent research programs in the Defense Advanced Research Projects Agency/Cybernetics Technology Division (DARPA/CTD). The very basic thrusts of the late 1960s and early 1970s have been superceded by an impressive number of less basic--and more applied--efforts. In the domain of crisis analysis and I&W, the extensive basic research is chronicled in Hopple and Rossa (1980) and the applied inquiry in Daly (1978).

1.2 Problem Statement

The Crisis Early Warning and Monitoring System (EWAMS) was initially designed to focus on three central problems:

- The development, evaluation, and improvement of procedures for monitoring and warning of international security crises
- The identification and observation of quantitative non-military indicators for crisis warning
- The integration of quantitative indicators and methods into an interactive, user-oriented, computer-based crisis early warning and monitoring system

In an attempt to resolve these and related problems, attention has been devoted to the development and testing of political indicators and the application of methodologies designed to enhance monitoring and lengthen lead time before crises. The results of progress in computer hardware/software and newly developed conceptual and analytical constructs and approaches have been and are being applied to an array of early warning problems.

The problem of crisis early warning is a complex one and has been thoroughly described elsewhere. The Department of Defense (DoD) has recently allocated a great deal of attention to the development of methods designed to enhance overall crisis warning and management capabilities. Currently, responsibility for the analysis, forecasting, management, and avoidance of future crises is spread across a number of governmental offices and agencies, including the Defense Intelligence Agency (DIA), the offices of Assistant Secretary of Defense for Intelligence (ASDI) and International Security Affairs (ASDISA), the Central Intelligence Agency (CIA),

the National Security Agency (NSA), and the Defense Science Advisory Board (DSB). Thus, the warning process encompasses various centers within the national security community.

It is clear that in order to improve the warning time of intranational and international crises, technology for that purpose must be continually developed and tested. Furthermore, if the technology is intended for actual use, it must be tailored to the preferences and needs of those individuals who are participants in the warning process. The staff of the Early Warning and Monitoring Project has approached the warning problem by focusing on the development of technology to improve and facilitate the monitoring and warning processes.

The complexity and sophistication of the warning process demonstrate that many international problems and crises encompass a much broader range of factors than military ones. Furthermore, research has suggested that, until these non-military factors (such as political and economic forces and trends) are identified and quantified for observation and testing, there is little likelihood that they will systematically and positively contribute to DoD's ability to monitor interactions and forecast crises to the extent that military indicators track affairs and facilitate the anticipation of unusual situations and crises. Consequently, it is

quite possible that the lack of emphasis on quantitative work in the realm of political and other non-military indicators could seriously impair the ability of the United States to forecast and manage crises. This is because any final assessment of early warning, such as an overall judgment of the likelihood of hostile action, is critically dependent on political, social, economic, and military information.

Since analysts are required to arrive at judgments regarding impending crisis events, it is critical that the analyst have access to appropriate technology to assist him in arriving at more accurate and valid judgments. Additionally, the goals and priorities of the Department of Defense require a commitment to the improvement of the early warning process. This commitment necessitates continued development and testing of an integrated, user-oriented crisis warning system. Currently, there is a paucity of work on integrating quantitative indicators of intra- and international crises, developing warning systems based on political indicators, and developing user-oriented, computerized systems.

Recognition of the importance of quantitative, non-military crisis indicators leads to an identification of several different types of related problems. Among the many factors which contribute to the overall warning problem are:

- Supplementing warning systems with monitoring and retrieval systems
- Coordinating and integrating the methodologies and data of extant early warning projects and developing new ones
- Tailoring early warning systems to user needs
- Implementing an efficient and effective transfer of the system to the user community

1.3 Toward a Solution

Many important aspects of the initial problem cluster have been resolved. For example, the number and nature of quantitative indicators for crisis warning have been measured as well as tested. Additionally, the indicators and forecasting methods now reside in an interactive, computer-based system.

Potential solutions to the many remaining problems have been outlined. Strategies for completing the successful conceptual and methodological transition from a monitoring to a warning system have been identified. As new components are integrated into the system, they must be rigorously tested and evaluated. A significant amount of testing of quantitative political indicators has already been accomplished; retrospective testing and testing with real-time data must be continued, as must interaction with potential users. To date, feedback from potential users who have seen the system has resulted in many valuable comments and

suggestions on substantive and cosmetic modifications which might make the system more useful and attractive to those in the I&W community.

Under the terms of the DARPA/DIA Memorandum of Understanding (MOU), the testing will be conducted at DIA/NMIC. The transfer to the European Command (EUCOM) site has also been initiated. Testing at other potential testbed sites will occur at the direction of the COTR. Such testing will facilitate and enhance the system's utility to those who will eventually work with it.

While great progress continues to be made on the Crisis Early Warning and Monitoring System, the above indicates that much remains to be done. It is important that, as progress on a solution to the warning problem continues (a solution in the form of a multi-source, multi-indicator, multi-method, interactive computerized system), a broader problem is not ignored. The latter is the problem of integrating the results of current work being carried out by other DARPA/CTD contractors and transferring the final product to potential users at testbed sites.

These multi-dimensional solutions to the problems associated with improved crisis early warning yield the following general research objectives:

Objective 1: Continue development of a user-oriented computerized Crisis Early Warning and Monitoring System. This objective requires the continued development and integration of international political and other (e.g., intranational, expert-generated, etc.) indicators into the computerized early warning system.

Objective 2: Continue testing and evaluation of the Crisis Early Warning and Monitoring System. This objective requires continuation of the development of computer software and the application of hardware needed to implement the system. This objective also requires continuation of the highly successful interaction with potential users in order to tailor the system to their needs.

Objective 4: Integrate and transfer a user-oriented, multi-track, multi-source, multi-method Crisis Early Warning and Monitoring System. Once the development, testing, and evaluation processes are completed, it will be necessary to integrate the diverse results into the system. Transfer of the real-time early warning and monitoring system will also necessitate very close coordination with potential users at testbed locations.

In connection with the objectives outlined above, the International Public Policy Research Corporation (IPPRC) plans to accomplish the following general tasks during FY 81.

Task 1. Continue to collect and integrate data sets into the Early Warning and Monitoring System. Develop new indicators based on: region-specific international political event/interaction data; national capabilities data; and real-time, expert-generated data. The final integration of these data sets and indicators will make possible the realization of a multi-source, multi-track, user-oriented early warning and monitoring system.

Crucial to the successful completion of Task 1 is the continued real-time data collection, employing the New York Times and Manchester Guardian. The two sources are coded for international political event/interaction data and extend from January 1, 1966 to the present in the case of the former and from October 1, 1978 to the present in the case of the latter. In addition to maintaining and integrating data on a current, daily basis, quality control procedures will be maintained and implemented.

Task 2. In part based on the data sets integrated in Task 1, continue to develop the EWAMS by testing, evaluating, and integrating political indicators. Develop new crisis indicators for daily and weekly data. Develop new crisis indicators based at least on rates of change, weights, and lead-lag considerations. Continue to develop the scanning capability of the system.

Task 3. Continue retrospective testing of the EWAMS. In coordination with DIA/NMIC under the terms of the DARPA/DIA MOU, continue retrospective testing and evaluation of political indicators, scans, and probabilities.

Task 4. Continue to maintain, obtain, and integrate as much current and daily updated data as possible. Under the terms of the DARPA/DIA MOU, coordinate with DIA/NMIC to test and evaluate crisis indicators, scans, and probabilities in a real-time, off-line mode. Based in part on these tests and the input of DIA and EUCOM analysts, modify the EWAMS. At the direction of CTD, carry out periodic assessments of the quality of WEIS data collected on a daily basis. Where necessary, modify the format and content of analytic and descriptive WEIS data at regular intervals.

Task 5. Continue to identify, test, and evaluate new forecasting methods for crisis early warning. The forecasting methods shall include: Markov renewal process models; stochastic, optimal control models; and real-time, expert-generated models. Evaluate and, where appropriate, integrate these forecasting methods into the EWAMS in order to enhance the system's multi-method forecasting and warning capability.

Task 6. Continue to develop and document interactive software for the EWAMS. Under the terms of the DARPA/DIA

MOU, seek input from DIA analysts and modify EWAMS software to meet their needs. To as great an extent as possible, continue to develop the hardware and software configuration to be compatible with those of other CTD contractors. Solicit DIA, EUCOM, and other user evaluations on the appropriateness of all newly developed indicators and enhancements or modifications to current and potential users. In coordination with the staff at CTD's Demonstration and Development Facility (DDF), complete the software needed to successfully implement the automated I&W capability. Also in coordination with DDF, continue integrating color graphics and other display technology enhancements.

Task 7. Coordinate with DIA/NMIC and EUCOM to integrate and transfer each tested and evaluated component of the EWAMS to the DARPA/DIA Testbed and to EUCOM. In conjunction with DIA analysts at the Testbed, modify EWAMS as feasible to meet their needs. At the direction of CTD, assist in the transfer of the system to other potential users. Update and disseminate preliminary user's manuals as the system evolves.

Task 8. Continue to test and evaluate subjective methods for crisis warning. These should include, but not be limited to, the data and methods associated with real-time, off-line Markov renewal process and other appropriate

models developed by other CTD contractors. Develop and test procedures for integrating these and other expert assessments into the system.

2.0 THE EARLY WARNING AND MONITORING SYSTEM: AN OVERVIEW

The philosophy which underlies the Early Warning and Monitoring System (EWAMS) is that human experts, the core of the I&W analytical process, can benefit from systems which supplement and enhance (but never replace) their intuition, judgment, and expertise. Ideally, such systems should reflect the fallible nature of any single source, indicator, and methodology. The EWAMS, for example, is multisource and features multiple indicators. There is also an array of forecasting methodologies available to the analyst.*

Extensive research has been conducted on the Early Warning and Monitoring System.** This research has been concerned with the data, indicators, and probabilities which represent the key features of the overall system. The concept of an event undergirds the entire effort.

Figure 2-1 portrays the elements of the concept of an event, a discrete and official verbal or physical action which is characterized in terms of who (actor) does what (event

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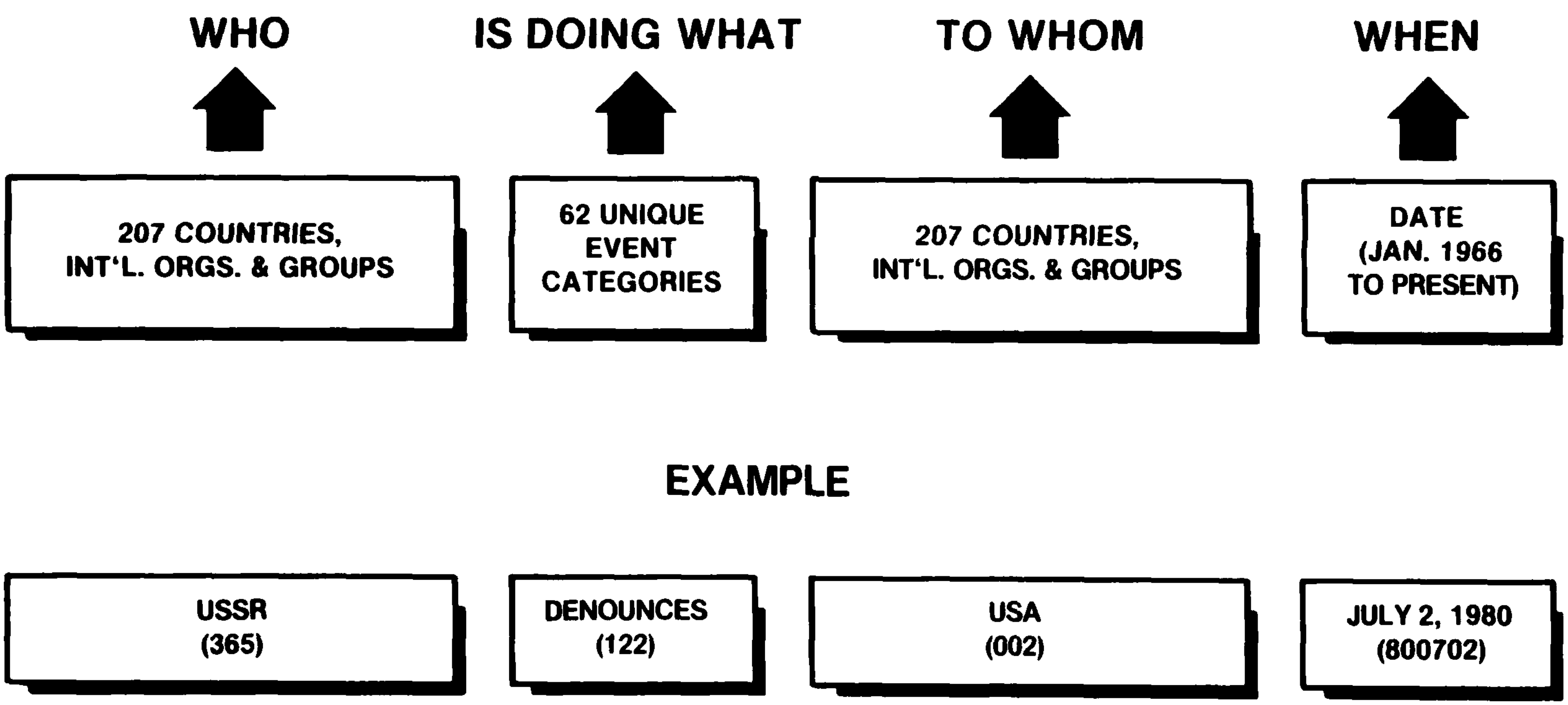
*EWAMS is built around an objective/extrapolative warning methodology; other research efforts in the DARPA/CT program have focused on subjective and other methodologies. See especially Job and Duncan (1980).

**See Section 3.0 for a summary of EWAMS research.

Figure 2-1

POLITICAL INDICATORS: EVENT DATA-BASED



type) to whom (target) when (date). The narrative or textual data are converted into quantitative data and the latter are in turn transformed into indicators (Figure 2-2).

Event data may be extracted from any classified, private, or public source; the methodology of event data is uniform regardless of data source and consists of a set of systematic and replicable rules for converting verbal material into coded data. The current "master version" of the system relies on two sources: New York Times (NYT) and Manchester Guardian (MAG). The NYT data base extends from January 1, 1966 to the present and the MAG from October 1, 1978 to the present.*

The event data and indicators are the foundation for EWAMS conflict probabilities. Currently offered only for monthly data (although work is proceeding on daily and weekly probabilities), the probabilities range from .01 to .99. They are generated from discriminant analysis, a social science methodology which classifies data into one of two categories.** For example, the Internal Revenue Service uses discriminant analysis to classify tax returns into audit/do not audit categories. Analogously, a weather forecaster might use the methodology to classify data into rain/no rain.

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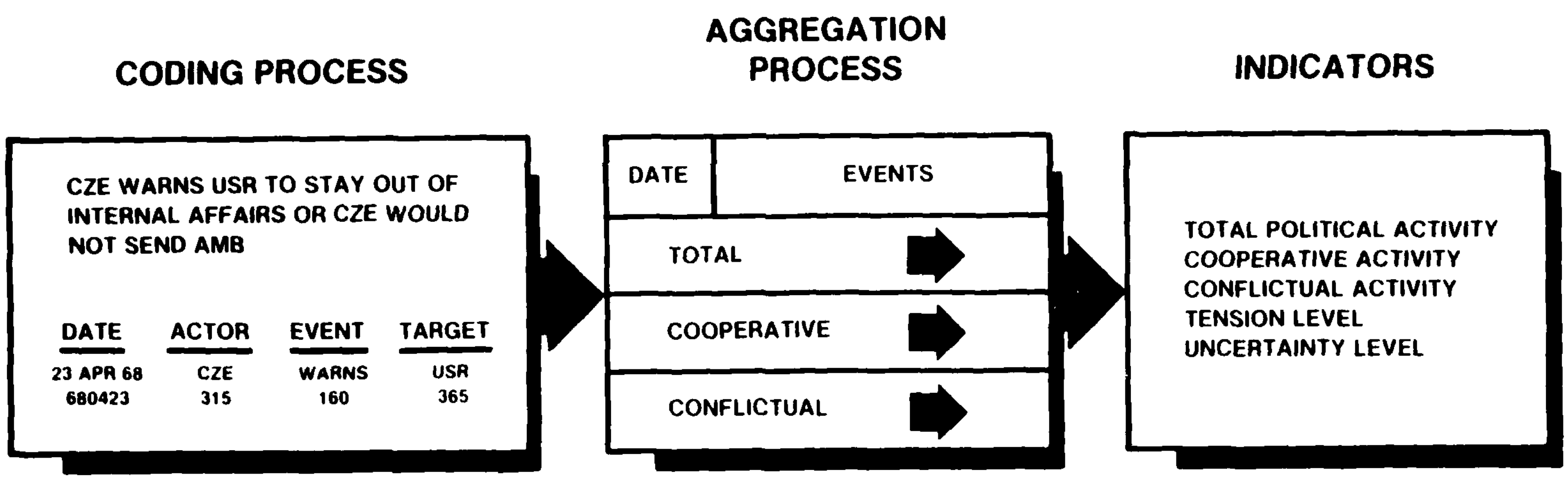
*The data are collected in virtual "real-time," which means that today's EWAMS includes NYT data up to yesterday. We have experimented with Reuters wire service data as well.

**Details are provided in Section 4.0 below.

Figure 2-2

POLITICAL INFORMATION TO POLITICAL INDICATORS



The structure of the EWAMS is depicted in Figure 2-3.* The analytic EWAMS is designed to provide a wealth of monitoring and warning indications to the analyst who is interested in scanning any international situation--especially if the analyst wants to look in detail at a country pair. In contrast, the automated EWAMS scans a number of international situations and reports both global "hotspot lists" and monitoring and warning advice and alerts. The analytic and automated components are described in detail in Section 3.0.

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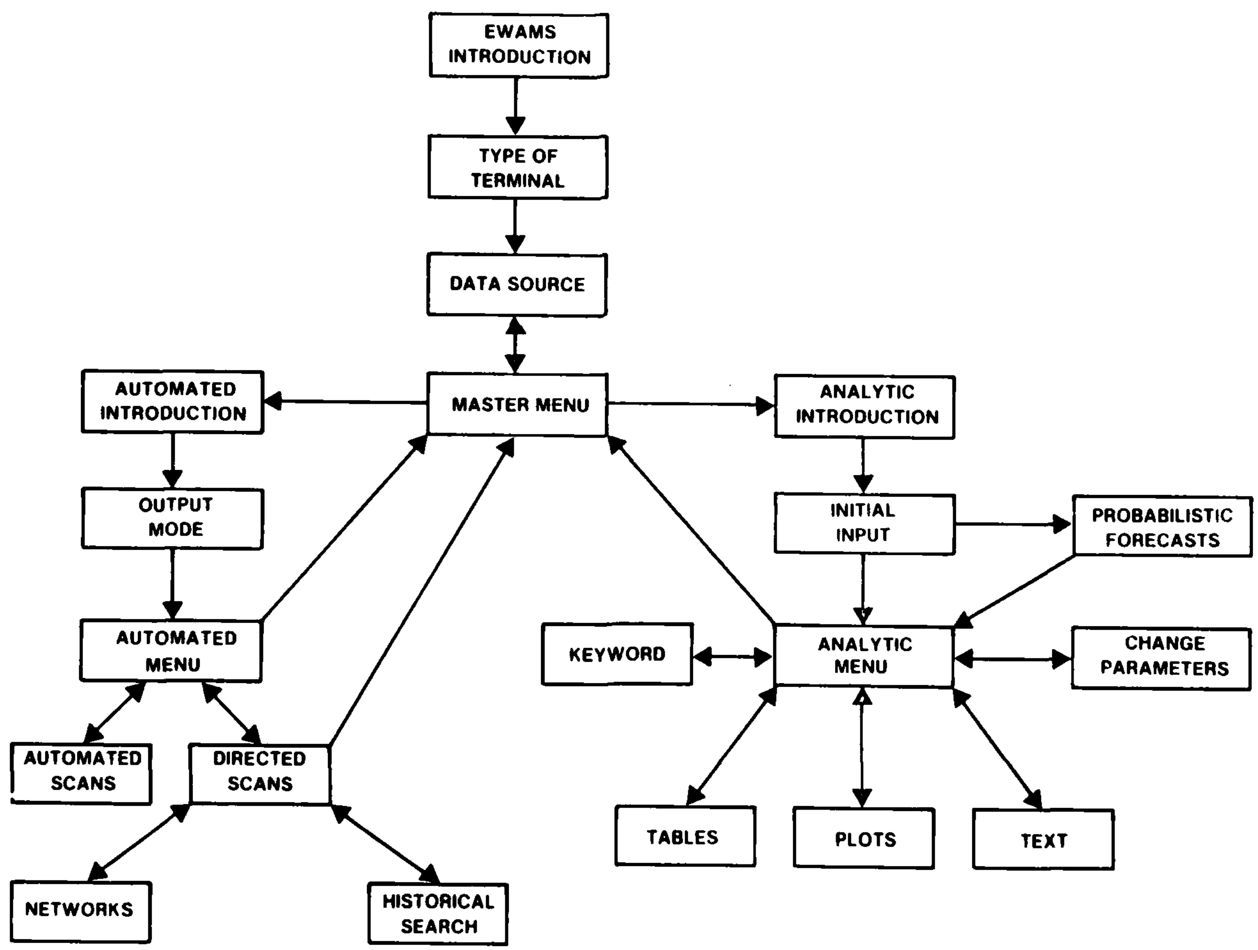
*There is a third module, which features Country Activity Profile (CAP) scores for any country and time period in the world. Each CAP score provides a reading for that country's activity as a proportion of world activity; the data are normalized or standardized so that the reading is relative to the country's past performance. For details, see Hopple and Snyder (1979).

Figure 2-3

THE EARLY WARNING AND MONITORING SYSTEM: AN OVERVIEW



3.0 SUMMARY OF RECENT RESEARCH

This section summarizes the progress which has been made during this and earlier contract phases regarding the development, testing, and enhancement of an international I&W Crisis Early Warning and Monitoring System. The primary purpose of the research has been to develop and test an integrative and user-oriented early warning system.

3.1 Initial Research

An outgrowth of extensive basic and applied national security and international affairs research and analysis (much of it supported by DARPA/CTD), the Early Warning and Monitoring Project was launched in 1976. This section provides a summary of the research progress from 1976 through 1979; extended treatments of the various research and software findings and developments are available in Andriole (1976), Bell et al. (1978), Daly and Davies (1978), and Wittmeyer (1976) and the structure and nature of the EWAMS as of June of 1979 is detailed in a Sample Output package (IPPRC, 1979).*

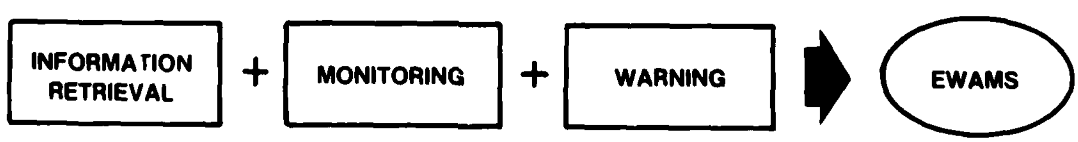
The three core functions of the EWAMS--information retrieval, monitoring, and warning--have remained central

*A new Sample Output has since been published (IPPRC, 1980c).

and are displayed in Figure 3-1. The underlying design of the system has been greatly influenced and clarified by a clearer conceptualization of the overall relationship between monitoring and warning processes (Martino, 1972). Two components of monitoring and warning have received a great deal of attention. These are indicator thresholds and the requirement for current data. Thresholds are not a new system component but their importance has been greatly increased by two concerns: (1) requirements of the user community, and (2) the need to successfully make the transition from a monitoring to a warning system. For the EWAMS to be useful in an operational environment, its indicators must be based on current and regularly updated data. This requirement has influenced the amount of attention which we have given to the development of indicators included in the original design for a fully integrated EWAMS.

Figure 3-1

THREE SYSTEMS IN ONE



3.1.1 <u>Quantitative indicators</u>. Extensive testing has been performed on all components of the EWAMS. Such testing has been facilitated by the nature of the system's core data

base--the DARPA-supported World Event Interaction Survey (WEIS). WEIS data, which are collected on a daily basis and in a real-time mode at IPPRC, now consist of over 100,000 non-routine international events for all countries of the world from 1966 to the present. The nature of the data base has permitted the testing of indicators, probabilities, and thresholds over a large number of historical crises. Daily updating of the data has been ongoing since the fall of 1979 and has facilitated the most crucial aspect of testing--real-time monitoring and warning on a daily basis.

All of the EWAMS indicators are derived from the WEIS events data. Quantitative indicators based on international events may be used to monitor international affairs through the "tracking" of indicator performance over time. Often, such monitoring results in the illumination of unusual changes or patterns which signify new problems and potential crises.

Crisis warning is achieved through the integration of quantitative indicators and forecasting tools; aside from the analyst's forecasting expertise (intuitive skill), such other methodologies as probabilities or trend extrapolation techniques may employ the data provided by event-based indicators to warn of crises.

The EWAMS features <u>ten core political indicators</u>. As displayed in Figure 3-2, indicators of <u>volume</u> and <u>variety</u>

Figure 3-2

EWAMS CORE INDICATORS

	Raw	Standardized (Z-Scored)
Volume	Total Activity Level Cooperative Activity Level Conflict Activity Level	Total Activity Unusualness Cooperative Activity Unusualness Conflict Activity Unusualness
Variety	Tension Level Uncertainty (Hrel) Level	Tension Unusualness Uncertainty Unusualness

are available. Furthermore, each raw indicator (i.e., actual score) is accompanied by a standardized (statistically normalized) version which can be used to assess unusualness.

The total activity level measures the sheer number of event/interactions exchanged. All political events are counted, regardless of WEIS category. This raw indicator of volume is useful because political activity levels tend to increase prior to (and during) a crisis between countries.

Total activity is subdivided into the two general forms of cooperative activity and conflictual activity; in the WEIS coding scheme, event categories 1 through 10 are designated "cooperative" and the remaining categories 11 through 22 are defined as "conflictual." The cooperative activity level is the number of exchanged events coded as cooperative; the

conflictual activity level is the number of events coded as conflictual.

Just as total activity increases prior to and during a crisis, conflict and cooperation also increase. However, the two sub-type of activity offer diagnostic capabilities beyond that of the total activity level indicator; by decomposing overall activity into more discrete and interpretable components, the nature of the interactions is further illuminated.

The variety indicator of tension level utilizes the conflict/cooperation division of events in order to provide a more qualitative measurement: the relative "conflictualness" of interactions. Tension level is defined by the algorithm:

$$\text{Tension Level} = \frac{\text{Conflict activity level}}{\text{Total activity level}} - \frac{\text{Conflict activity level}}{\text{Total activity level}^2}$$

Thus, the tension level is the percentage of events which is conflictual; the percentage is adjusted to consider the inflationary effects of low total activity levels. Tension levels may vary from 0 (no conflict activity) to 100 (all activity is conflictual). Tension levels tend to increase to 70 or more prior to and during crises and conflict activity begins to predominate over cooperative activity--even as both increase.

Uncertainty, or Hrel, levels tap another form of variety which tends to increase in times of crisis. This measure uses the 22-category breakdown of WEIS events in order to assess the degree to which activity is dispersed across the many forms. To the extent that activity is equally distributed among all possible categories, uncertainty in events is high. The exact formula is drawn from communications theory:

$$Hrel = \sum_{n=1}^{22} P_n * \frac{-\log P_n}{-\log (1/22)}$$

where P_n is the proportion of all events which are in category n. When uncertainty is highest, each category has an equal number of events (1/22 of the total) and Hrel equals one; uncertainty is lowest when all events are of one type, resulting in an Hrel of zero. Uncertainty in events tends to increase in periods of crisis, reaching levels of 0.7 or more.

Although each of these indicators is useful in a system designed to monitor and warn of international crises, research has demonstrated that warning capability is enhanced when indicators are standardized or z-scored. Standardization involves the transformation of a raw indicator into an unusualness score, which takes into consideration the historical performance of an indicator for a particular dyadic (two-country) relationship, i.e., the indicator reading is adjusted to

reflect the degree of unusualness when compared to prior readings.

The formula for the conflict activity unusualness score will serve as an example of the transformation; the formula does not vary across raw indicators:

$$\text{Conflict Activity Unusualness} = \frac{\text{Conflict Activity Level} - \text{Average of Previous Conflict Activity Level}}{\text{Standard Deviation (Dispersion of Previous Conflict Activity Levels)}}$$

The words Conflict Activity may be changed to any other indicator (Total Activity, Cooperative Activity, Tension, or Uncertainty) in order to provide its unusualness score formula.

The unusualness score indicates the degree to which the current indicator reading differs from past readings. An unusualness score will equal zero if the current reading is "average" compared to the past. To the extent that the reading is unusually high, the unusualness score will be high; "unusually high" refers to a situation in which the reading is higher than average and more so than expected on the basis of past variations (standard deviation). Conversely, an unusualness score may be a large negative number when a reading is unusually low compared to the past. Unusualness indicators can therefore range from very large negative values to very large positive values (especially in precrisis and

crisis periods); the scores tend to approach zero in normal situations.

In addition to the delineation of the core dyadic (country pairs) indicators, early EWAMS research, summarized in Andriole (1976) and Daly and Davies (1978), concentrated on other potential approaches and strategies. For example, single country activity was explored in a preliminary fashion; work focused on the ROZ (row percentage and column z-scores) indicator. ROZ takes into account a country's daily, weekly, or other (monthly, etc.) portion of total world action and the degree to which that portion is statistically exceptional compared to a ten-year average.

ROZ proved to be an effective warning sign of impending danger, a monitor of on-going trouble, and an indicator of post-crisis shock (McClelland, 1976). As such, ROZ contributes to all three functions of the system--information retrieval, monitoring, and warning. ROZ was used to help determine which countries should be added to a sample for developing and testing indicators of intranational conflict and of intra- and international conflict linkages (Daly and Hopple, 1977).

3.1.2 General scans. General scans, i.e., tracking groups of countries that reflect user interests, are designed to enhance analyst efficiency. More specifically, a scan is

an aggregation of countries by one or more criteria, e.g., a scan defined by geographic location aggregates countries into groups such as a Middle Eastern region (Wilkenfeld et al., 1978).

A general scanning capability improves the monitoring and warning performance of the system in many ways. A general scan allows an analyst to look at several countries taken together rather than looking singly at many country pairs. If the indicators for the group suggest unusually high activity, tension, or uncertainty, the analyst can drop to the country-by-country level or even track the recent activity of a single country to determine the source of the disturbance on the regional level. More generally, scans can be viewed as having four primary purposes:

- To increase analyst efficiency
- To lengthen the warning time before crisis
- To monitor and provide a characterization of the relationship between country pairs and the world as a whole
- To facilitate and enhance crisis management

The master version of the EWAMS is now front-ended with JCS regions. This particular scan allows the analyst to track a JCS region, to look at any combination of countries within that region, any combination of countries outside the region, any country within any region, and to create special

purpose user-tailored regions. Extensive research revealed the utility of employing JCS and other regional scans.

3.1.3 Computer base. The master version of the Crisis Early Warning and Monitoring System's computer base is now located at DARPA/CTD's Demonstration and Development Facility (DDF). The status of the early warning system hardware and software can be summarized as:

1. Hardware
   a. PDP 11/70 minicomputer
   b. Tektronix 4027, 4051, and 4052 graphic terminals
   c. Tektronix 4631 hard copy units
   d. Tektronix 4907 floppy disc
2. Software
   a. UNIX operating system
   b. CULC's Fortran IV Plus
   c. Tektronix Plot 10
   d. Binary and random access data files

Early project software also ran on a standalone Tektronix 4051. Standalone software programs were developed for testing new political indicators such as ROZ as well as for evaluating the warning capability of extant political indicators like the tension measure.

3.2 FY 1980 Research

The software and political research and development processes of the early phase of the project provided a firm foundation for FY 80 research and analysis activities. In addition to the continued testing and development of quantitative indicators, this phase has also been characterized by an intensive (albeit preliminary) real-time test and evaluation program. Furthermore, there have been numerous extensions and enhancements of earlier thrusts as well as several distinctive lines of inquiry.

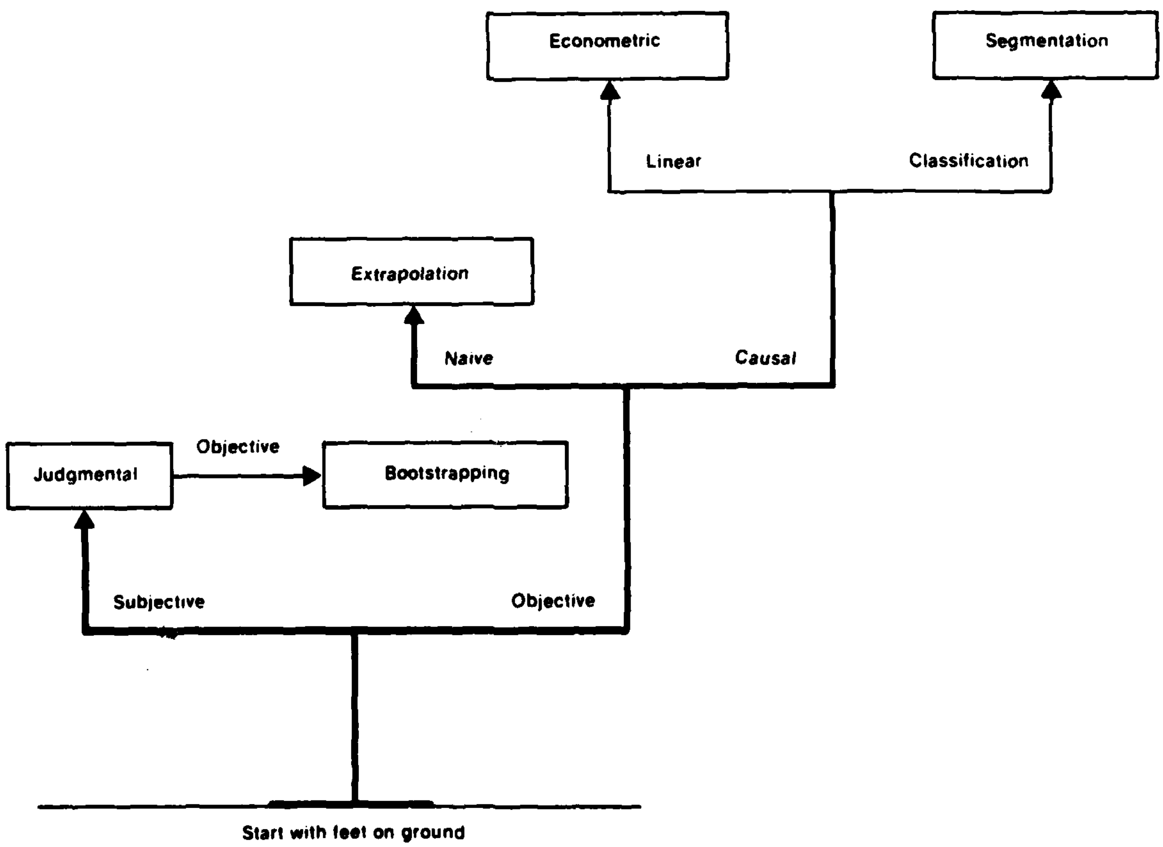
Among the latter are various research efforts designed to improve and increase the rigor, validity, and reliability of the crisis warning component of the EWAMS. Secondly, the automated I&W module was converted from a blueprint into a detailed design and has been substantially programmed and implemented. The other major component of EWAMS--what is known as analytic I&W--was significantly expanded and enhanced. Dual source assessments and software development and implementation represent two additional areas where progress has been sustained.

3.2.1 Crisis warning. During the early phases of development, EWAMS relied on an associative-extrapolative crisis forecasting methodology. Figure 3-3 depicts the range of forecasting methodologies potentially available

to the I&W analyst. The continuum extends from intuitive to very "objective" methodologies. The initial EWAMS forecasting procedure was associative or extrapolative in nature; it contained a base of patterned cases (a conflict or crisis file) and viewed future crises an analogies to past ones. Activity, cooperation, and conflict probabilities in EWAMS reflected a prediction of the unknown (the short-term future) from the known (prior patterns).

Figure 3-3

THE FORECASTING METHODOLOGY TREE*



*Source: Armstrong (1978).

During FY 80, an alternative procedure--discriminant analysis--was incorporated into the EWAMS and replaced the simple extrapolative crisis warning methodology. This major change had been preceded by an extensive program of retrospective testing and evaluation.

In order to test the accuracy of the discriminant methodology for crisis warning, an historical data base covering 1966-1978 was constructed; thirty crises, including forty-eight nation pairs, were included and provided with a start-date. Using these crisis (start-) months and the eleven prior months in each case, the warning accuracy of the initial EWAMS indicators/probabilities was assessed:

- Overall, a credible 90 percent of the forecasts provided by the initial EWAMS indicators/probabilities are correct
- The "average" crisis forecast is correct in 54 percent of the cases and forecasts 33 percent of the actual crises
- Current warning capability is weak when a one-month lead/lag before the crisis is utilized

The discriminant analysis results were comparable and employed all indicators, as well as a dual approach which permitted "conservative" forecasting. The results included the following:

- Overall success remains credible: 86 percent to 92 percent of the forecasts are correct (depending upon the desired degree of conservatism)

- The "average" crisis forecast is correct in 30 percent of the cases (50 percent when conservative), and 55 percent of the crises are forecast (20 percent when conservative)
- Warning capability is only slightly improved when a one-month lead/lag is introduced, with performance below desired levels
- The "average" crisis forecast is correct in 30 percent of the cases (50 percent when conservative), and 55 percent of the crises are forecast (20 percent when conservative)
- Warning capability is only slightly improved when a one-month lead/lag is introduced, with performance below desired levels

Thus, the use of discriminant analysis for the purpose of estimating crisis probabilities resulted in forecast accuracies no less impressive than those previously generated. The efficiency of the methodology recommended its use within the EWAMS. Furthermore, extensions made possible via the new method portend increased accuracy; for example, various time increments and z-score tails may be employed and multiple indicators may enter into probability calculations.

3.2.2 Automated I&W. Hopple et al. (1979) discuss the detailed blueprint for the automated I&W module of EWAMS; this section offers an overview and provides an account of the extensive software and research progress.

If the user selects automated I&W, he will initially choose one of two general options: alerts versus directed

scans. A developed alert option is already available. Directed scans will feature three distinct subroutines:

- Networks
- Forecasts
- Historical searches

The third is already operational and the other two components of directed scans will be developed in the future.

Alert scans are defined by the system rather than by the user; all reporting criteria are pre-determined for the purpose of providing the I&W analyst the most meaningful information in a standardized mode. (The analyst can specify his own criteria in the directed scanning option.) The system-defined criteria reflect those prior (and ongoing) research findings which pinpoint the most productive thresholds and methods for isolating meaningful alerts for monitoring international affairs and anticipating security crises.

The existing prototype is patterned on the real-time assessment criteria. That is, tracking or monitoring indicators and thresholds are:

- Tension, Hrel, and Conflict probability thresholds = 50, .5, .5

- Total and cooperative activity thresholds = .5

The warning indicators are:

- Tension, 70
- Hrel, .7
- Conflict probability, .7

The prototype is designed to limit the required user-inputs (see Figure 3-4). The long-term plan provides that eventually no inputs will be solicited from users; the system will perform all conceivable scans and the time parameter will automatically be "real-time" or current. Such fully automated alert scans will complement the analytic EWAMS as well as the directed scans module.

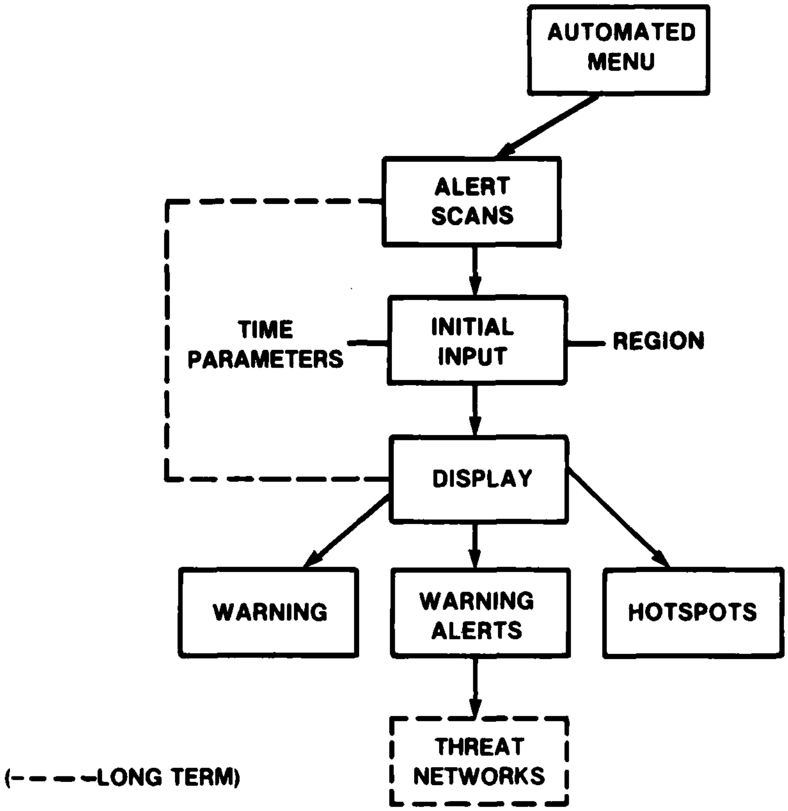
The current output includes:

- "Hotspots" (reports of the most serious conflict levels)
- Monitoring alerts (lists of situations which, as a result of unusual events, warrant more detailed scrutiny and more vigilant "watching" by the analyst)
- Warning alerts (lists of forecasted crises)

A future enhancement, As Figure 3-4 indicates, will be threat networks. Threat networks will permit the analyst

Figure 3-4

AUTOMATED ALERT SCANS



to map out those situations which are more explosive in nature. This subsystem of the alert scans option will facilitate the tracking of crisis and conflict spillover processes and will enable the analyst to discern potential crisis linkages.*

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*For example, the concept of second-order crises (crises not initially involving the concerned country) poses an array of challenges to international affairs researchers, policy analysts, and decisionmakers; the future international environment can be expected to provide U.S. I&W analysts and policy makers with a disturbingly large number of second-order crises which involve U.S. interests directly or indirectly. Recent examples include the Horn of Africa and Southeast Asia. Many of the Middle East crises exemplify potential crisis linkages; the 1973 Yom Kippur War, which "diffused" from the Arab-Israeli regional arena to the Soviet-U.S. "alert crisis," exemplifies this syndrome.

Conflict, cooperation, and "attention" networks are among the ones which could be offered to the user.

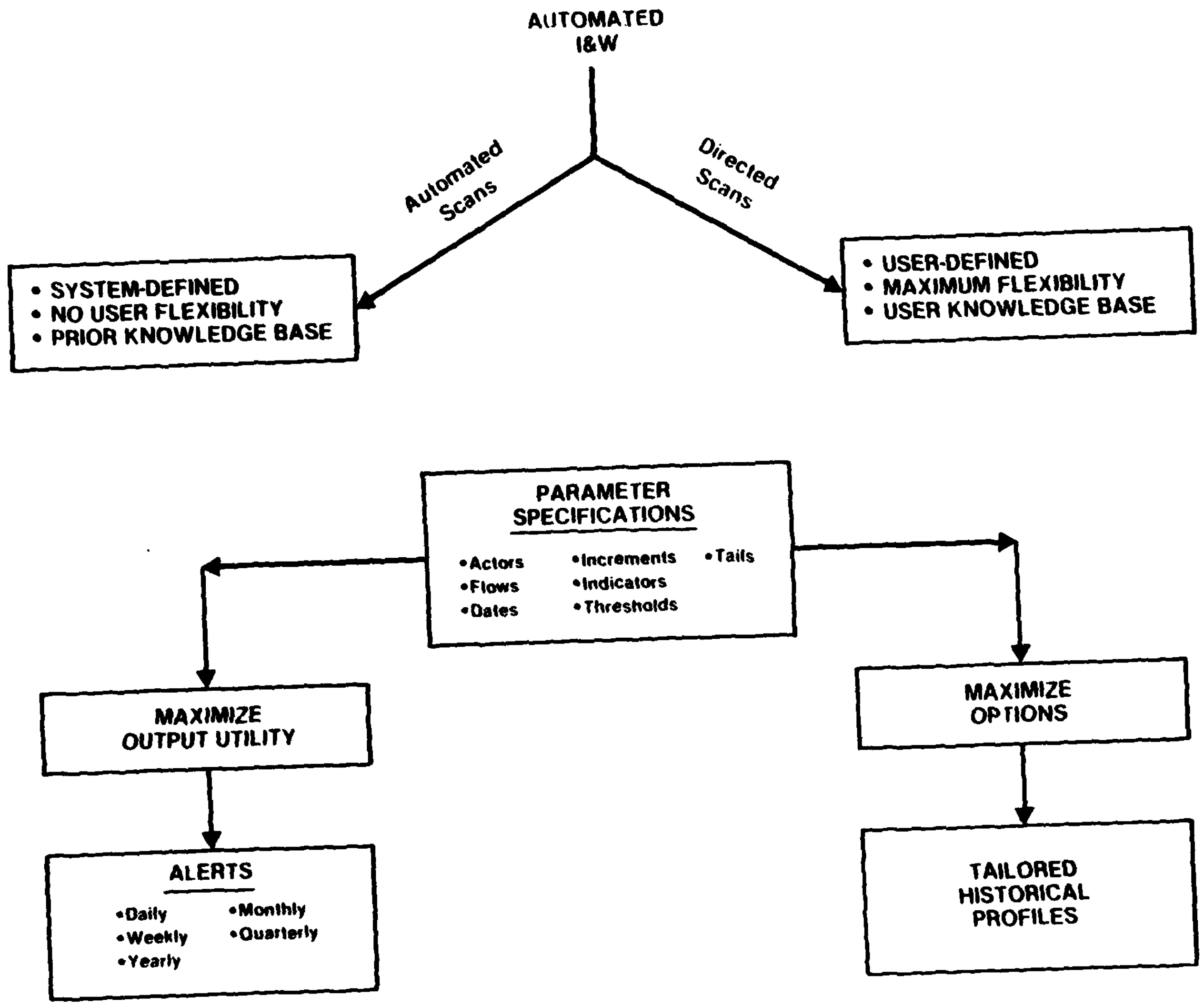
The alert scans prototype is heavily indebted to prior research accomplishments. The criteria for discriminating between potential crises and situations which are unlikely to erupt into crises can be expected to show appreciable improvements in performance as research progresses. The emphasis on attempting to achieve "hits" and correct rejections while avoiding "misses" (incorrect crisis predictions) and false alarms will continue to provide a set of exacting standards for evaluating indicators and thresholds.

Directed scans, the alternative option, maximize flexibility from the perspective of the user and emphasize the importance of the individual analyst's own knowledge, expertise, and wisdom. A sophisticated analyst can define his/her criteria for scans and alerts.

As Figure 3-5 suggests, these two automated I&W options, which will be developed simultaneously, seek to maximize orthogonal or contradictory goals. The linkage between alert scans and the historical search component of directed scans can be found in the parameter specification list: historical searches will accommodate any parameter specifications and will yield sets of user-tailored output, whereas

Figure 3-5

AUTOMATED I&W: AN OVERVIEW



alert scans utilize all of the possible parameter settings to maximize the range and enhance the utility of alerts.

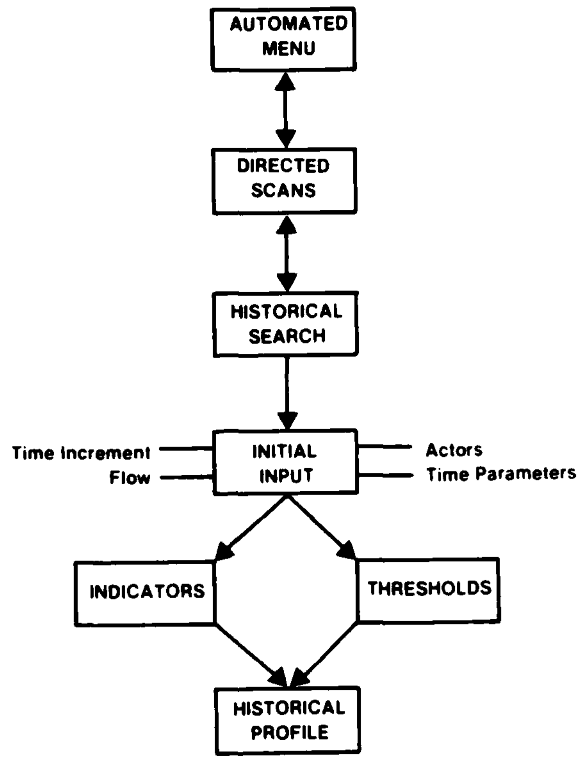
Each envisioned sub-module of the directed scans option overcomes one or more of the limitations associated with other parts of the EWAMS blueprint. The result is a subsystem which requires both "intelligent" data-processing methods (as in alert scans) and "intelligent" or sophisticated user-supplied inputs.

The historical search feature compensates for the limitations which characterize alert scans (Figure 3-6). The sophisticated user may be interested in obtaining "alerts" which are derived not from previous research results, but from the analyst's own knowledge base and interests. The time frame may be adjusted in order to observe the effects of historical situations or trends; scans can be limited to one or a few country pairs of interest; and indicators and thresholds may be designated by the analyst. The profiles which result from such user-defined specifications of criteria for alerts will thus automatically be tailored to the needs and interests of the particular analyst.

3.2.3 Analytic I&W enhancements. The Early Warning and Monitoring System is designed to aid and facilitate the analysis of interactions between or among countries for the purpose of assessing the likelihood of crisis or serious

Figure 3-6

DIRECTED SCANS: HISTORICAL SEARCH



conflict. The system queries the user for information which defines the input parameters:

- Actors (e.g., USA and IRN)
- Flow (e.g., USA toward IRN)
- Time increment (e.g., monthly)
- Time frame (e.g., 79/01/01 through 79/12/31)

In this example, the user asks to look at political actions (recorded in the *New York Times*) directed from the

United States toward Iran during 1979, with the information aggregated at the monthly level (i.e., twelve reporting periods). This example is depicted in Figure 3-7, which is a reproduction of actual system output.

The parameter specifications permit flexible "scanning" of international activity profiles. The user may examine any dyadic case (i.e., any country-to-country, region-to-region, or country-to-region set of actions or interactions). Each case may be analyzed for various time increments in order to observe daily, weekly, monthly, or yearly trends.

The major function of the analytic EWAMS is to provide meaningful indications, a variety of monitoring devices, and probabilistic warnings regarding the present trends of the case selected by the user.

The analytic EWAMS has continued to emphasize the originally posited four central components of the initial design:

- General scans
- Quantitative political indicators for monitoring and warning
- A unified multi-method forecasting capability
- A computer base

Figure 3-7

SAMPLE INPUT FOR THE ANALYTIC EWAMS

```
****** EARLY WARNING AND MONITORING SYSTEM ACTIVATED ******


Are your actors:
     1. Countries
     2. JCS regions
     3. Both          1

Please select two countries(usa,usr):  usa,irn

Specify activity flow:
     0. one way (usa >>> irn)
     1. one way (usa <<< irn)
     2. two way (usa <-> irn)  0

Select time increment:
     1. daily
     2. weekly
     3. monthly
     4. quarterly
     5. yearly                 3

Set time parameters(750101-771231):  790101-791231
```

However, the needs of potential users and the results of internal testing and modification have contributed new concepts and indicators. In addition to the introduction of an "automated" module, the analytic Early Warning and Monitoring System has experienced change and development.

Recent project research memoranda reflect the current trends and developments. Aside from the automated alert scanning/historical search features of automated I&W, the recent enhancements and developments include the following:

- International political event/interaction data at the daily level (in addition to the monthly, quarterly, and yearly options).

- International political event/interaction data at the weekly level.

- The addition to the basic system menu of "change input parameters." This option allows the user who is already in EWAMS to change the actors, flow, time parameters, time increment, data base, or all of the above. For example, if the user is looking at the USA and USR for February and March of 1979 (two-way) and wants to examine the USA and CHN for the same period, he would simply use the "change" option and enter the new pair of actors; the system would then automatically begin processing.

- Text for regions is now available.

- The user can now do runs for two special purpose regions (in addition to the existing capability of analyzing a special purpose region and another type of actor).

- Additional special purpose region options are now available. The user can save and retrieve special purpose regions as well as edit them (add to/ delete from). In addition to the "create-your-own" special purpose region(s), the user can now access the country attribute typology-based regions; these groups, based on research conducted at the University of Maryland, are clusters of nations which statistically share various political, economic, military, and national capability characteristics.

- In addition to the New York Times-based political event/interaction data, the user now also has access to comparable data coded at IPPRC from the Manchester Guardian. This alternative data base is especially useful for Western Europe and the Mediterranean area as well as sub-Saharan Africa, Eastern Europe, and South Asia.

- All output is now labelled by source (NYT for New York Times and MAG for Manchester Guardian).

- Special Purpose Indicators (SPI's) are now available to the user (for example, verbal versus physical conflict indicators or "create-your-own" special indicators).

- A single country performance indicator--Country Activity Profiles (CAP)--is now available to analysts.
- The user may change source (NYT ⟷ MAG) in all operational modules of automated I&W.

The central components of the analytic EWAMS reflect a dual thrust which pervades IPPRC's efforts to:

- Integrate and synthesize the best I&W-relevant research
- Integrate and adapt this research in the form which is most relevant to the user community

3.2.4 Dual source assessment. With the integration of NYT (New York Times) and MAG (Manchester Guardian) political event/interaction WEIS data into EWAMS, the user now has access to two separate data bases. The comparative performance of MAG and NYT has been assessed in retrospective and real-time modes.

This research, which has been reported in Hopple (1979a, 1979b, 1979c, 1980a, 1980c), has involved both the analytic and automated I&W components of EWAMS. Overall, the finding has been that MAG and NYT constitute two separate (albeit somewhat similar) "windows on the world." Although each has regional biases and strengths, the I&W analyst is advised in the typical case to use both data bases; this can be expected to provide a somewhat more reliable portrait of reality and minimize both "misses" and "false alarms."

In addition to WEIS, there are quite a few other events data sets in international and comparative politics. All are derived from one or more public newspapers or events data chronologies (e.g., Facts on File, Deadline Data on World Affairs, etc.). The various events data collections are designed to map the domains of international and intranational affairs (primarily but not exclusively internation conflict and crisis and intranation violence and instability).

Critics have been quite understandably skeptical of the practice of using public source data for the purpose of monitoring and attempting to forecast internation behavior patterns and crises.* For reasons of cost and accessibility, however, the typical international relations events data project has relied on completely public sources.

Ideally, an "on-line" intelligence-oriented international affairs tracking and crisis warning system--such as EWAMS--would consist of an array of public and private/

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*There has been some research on less open sources; the major example is the Foreign Relations Indicator Project (FRIP), which used the U.S. State Department's operational traffic as its source of data; see Burgess and Lawton (1972: 49-51). Slater and Orloski (1978) relied on Foreign Broadcast Information Service (FBIS) and cable traffic data in their research on Peruvian and Chilean intra- and international affairs.

classified data bases.* Such a system would impose a common data organization scheme on all types of incoming intelligence information, thus providing the intelligence analyst with a series of potential forecasts and estimates. Converging evidence would of course enhance the credibility of warnings; discrepancies could alert the analyst to the possibilities of "false alarms" (when one stream of data is incorrectly indicating a potential crisis) and "misses" (when one stream of data is ignoring a crisis detected by a second stream).

Although public source data are suspect for a variety of reasons, several rather compelling arguments suggest that such data generally perform credibly and that much of the skepticism is unwarranted. The first factor is that most of the "dialogue" which constitutes interstate relations is actually captured by the elite media. To an extent, in fact, the prestige media structure the decisionmaker's (and everyone else's) image of the world (e.g., by highlighting issues and shaping issue agendas, by focusing attention or ignoring a given subject, etc.).

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*Currently, a prototype study is being conducted by DARPA/CTD in the area of international and intranational event-oriented monitoring and warning systems with respect to sub-Saharan Africa (see, e.g., Hopple, 1979a). The effort is discussed below in Section II. IPPRC is amassing public source and FBIS data, while another contractor (Mathtech) is using an identical data collection scheme with cable traffic data.

It is well known, for example, that most intelligence data consist of publicly available information. It has been estimated that 90 to 95 percent of the data classified as "confidential" or above are from open sources. Not surprisingly, then, research on elite belief systems, which has relied exclusively on public source articulations (e.g., FBIS, New York Times, etc.) demonstrates that overtly stated elite beliefs and values are frequently related to actual behavior in the sphere of foreign policy; the magnitude of the belief-behavior linkage is often robust. This finding holds for both open political systems and for non-polyarchic regimes; for details, see Hopple (1980b).

The second reason for arguing that data derived from public sources like NYT and MAG are typically valid is the performance of the current version of the Early Warning and Monitoring System (EWAMS). While EWAMS is far from infallible, real-time tests and the kinds of detailed source comparisons chronicled here and elsewhere (see various EWAMS memoranda) both demonstrate that EWAMS is a fairly viable (i.e., reliable and valid) system for:

- Monitoring interstate interactions
- Forecasting serious conflict and crisis episodes (albeit more impressively for certain types of crisis)*

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*Such as, those which escalate gradually (e.g., Iran-U.S. in 1979, Czechoslovakia-Soviet Union, the 1967 Middle East War) as opposed to crises which erupt suddenly (e.g., the 1973 Middle East War).

The purpose or function of the EWAMS data collection operation suggests unequivocally that NYT should be supplemented by a second, non-U.S. data source. The purpose of the data collection operations is twofold: to provide a portrait of the major events in the sphere of international relations (in retrospective and real-time modes) and to enable intelligence analysts in the U.S. to monitor and forecast international affairs and crises. The data base should therefore be reasonably comprehensive, given the interests and emphases of U.S. intelligence analysts. Presumably, the New York Times, the major U.S. "prestige newspaper," provides a good "map" of the world of international political event/interactions as it is perceived by the U.S. national security analysis and policy making communities. The purpose of the Manchester Guardian data base is to supplement the New York Times perspective and correct for its biases. Additionally, MAG and NYT together will presumably maximize "hits" and minimize "misses." Empirical results for the source comparisons are presented in Section 5.0.

3.2.5 Software. FY 80 software development and enhancement activities were unusually salient in nature and extensive in scope and magnitude. In addition to providing ongoing analytic programming support, the EWAMS computer science staff made numerous refinements and cosmetic enhancements to the EWAMS; also, several exhaustive reviews were conducted with CTD, leading to further changes. The

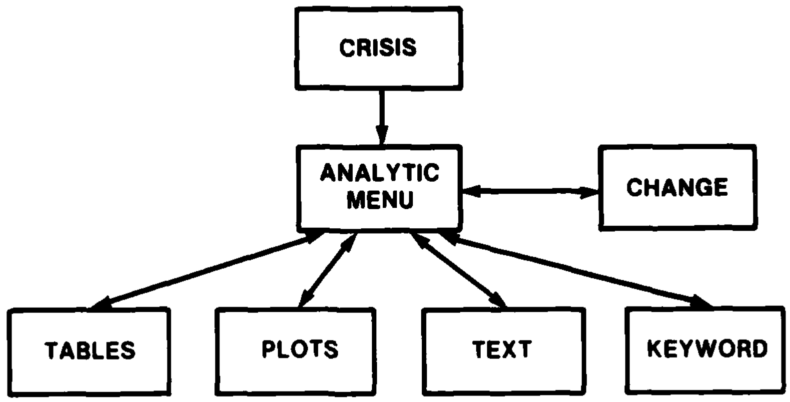
enhancements to the master version of the EWAMS, which resides on the PDP 11/70 at DARPA/CTD's DDF, include keyword, SPI (Special Purpose Indicators), CAP (Country Activity Profile scores)--all new features of the analytic EWAMS--and the entire automated I&W module. The staff also converted the EWAMS from an 11/70-based system written in FORTRAN to a Tektronix 4051/4907 file manager configuration written in BASIC; the latter was recently transferred to EUCOM/J-2 by CTD. Finally, work was recently completed which culminated in the release of a "new EWAMS" with new tails for indicators/probabilities, significantly reduced processing time, and an internally streamlined software structure.

EWAMS has grown considerably since the beginning of 1979. At that time, the system consisted of what is now known as the "analytic EWAMS." The six main routines (crisis, change, tables, plots, text, and keyword)--together with a library of 50 to 60 subroutines--comprise the analytic software (see Figure 3-8). This initial core of software, forming the basic structure of the entire system, has remained largely intact with certain enhancements (see Pulley and Snyder, 1979, for details). Figure 3-9 depicts the "current EWAMS."

The EUCOM/EWAMS, designed to facilitate the tasks of EUCOM I&W analysts, is patterned after the PDP 11/70-based EWAMS but was modified and tailored to the needs of EUCOM and to the hardware configuration of the EUCOM/EWAMS. A

Figure 3-8

ANALYTIC EWAMS



User's Guide (IPPRC, 1980b) and a Political Indicators Handbook (IPPRC, 1980a) were developed to accompany the EUCOM/EWAMS, which was recently transferred. A computer-based Instruction Aid Package was also programmed; a System Flowchart provides an overview of the software base of the EUCOM/EWAMS.

Figure 3-10 depicts the EUCOM/EWAMS "architecture." The system features two major components: text and crisis. The text component permits the user to retrieve actual text items; the crisis component offers four system options. In crisis, the user must enter input information (e.g., what countries he wants to look at and for what period) and may then have the results displayed in tabular or graphic (plots) form; he may also examine text or change the input information in order to conduct another analysis (e.g., study a different country pair for the same time period, analyze the same countries for a different aggregation and/or time frame, etc.).

Figure 3-9

CURRENT EWAMS

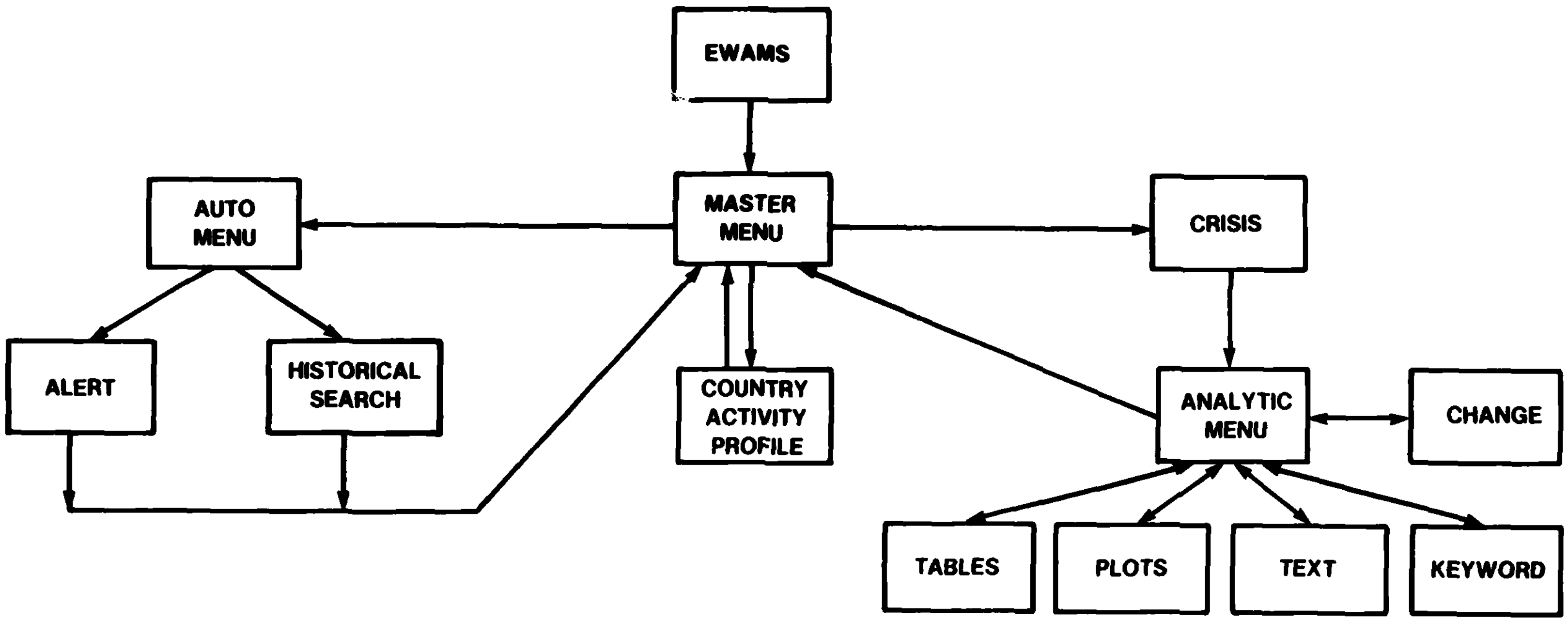
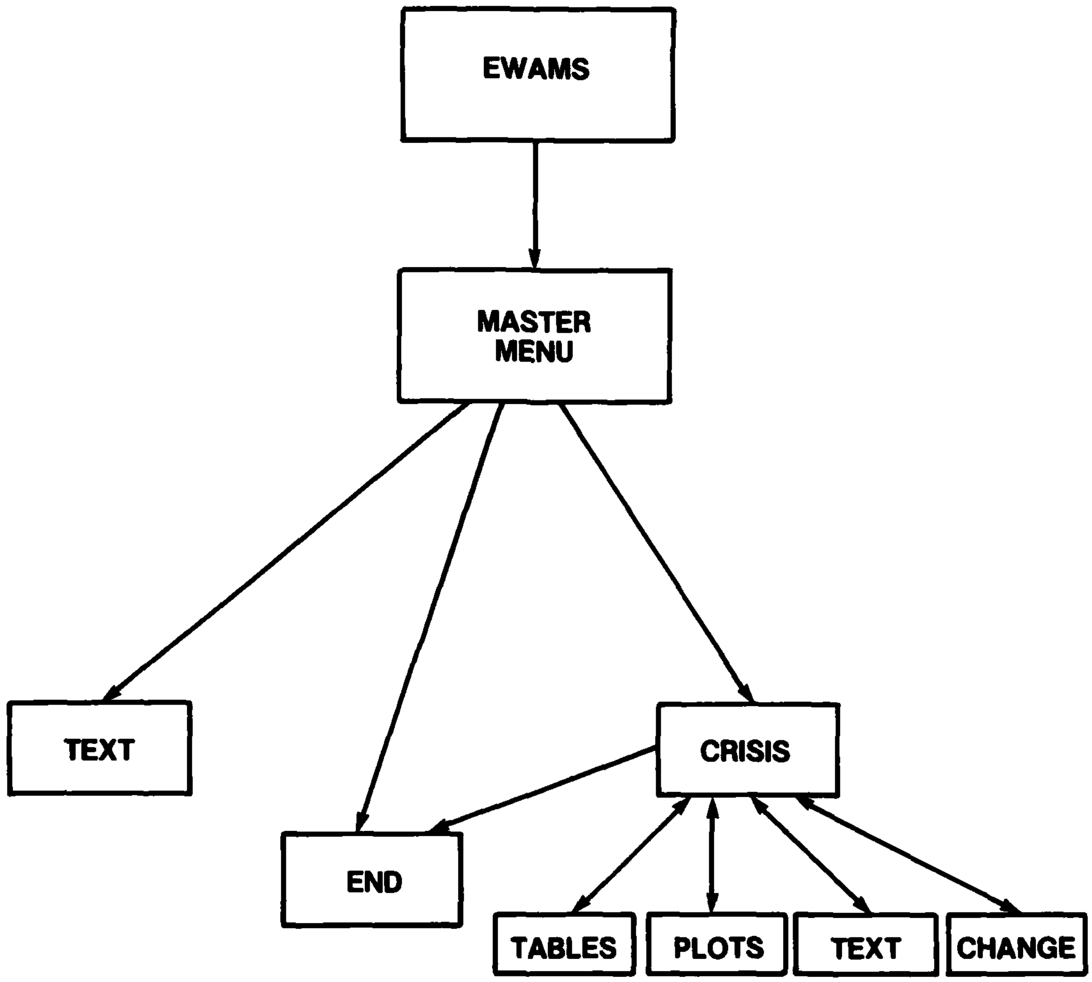


Figure 3-10

THE STRUCTURE OF THE EUCOM/EWAMS SYSTEM



The EUCOM/EWAMS utilizes a Tektronix 4051 graphics terminal/microprocessor and a 4907 File Manager. To activate and use the system, the user must insert the appropriate diskettes into the 4907. For runs involving the crisis module, the software and data base diskettes must be inserted; for runs in which the analyst wants only textual output, the software and text diskettes must be inserted. A tape must also be inserted into the 4051. These steps are all covered in the User's Guide (IPPRC, 1980b); the 4051-based Instruction Aid Package also reviews the use of the 4051.

4.0 PROBABILISTIC FORECASTING*

The Early Warning and Monitoring System (EWAMS) provides estimates of the probability of a crisis during any month for any nation pair. Such probabilities aid in the task of crisis warning by recommending "crisis" or "no crisis" forecasts while recognizing (and taking into account) a margin of error. The initial procedures for estimating EWAMS probabilities relied upon labor-intensive research which was limited to estimates based upon a single indicator. An alternative procedure--discriminant analysis--may be automated and may process multiple indicators to estimate crisis probabilities.

The numerous difficulties associated with providing warning of international crises are no more troublesome than a large variety of forecasting problems. However, international crises, which are unique and specific events, require forecasting methods which are compatible with the discrete nature of the subject matter. The "yes/no" dichotomy approach to crisis forecasting reduces the warning task to a simple statement of certitude, an absolute prediction within a world of uncertainty, margins of error, and experiential relativity.

Nevertheless, meteorologists who seek to forecast thunderstorms, tax auditors who hope to uncover false reports,

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*This section draws primarily on Rossa (1979c).

and many other professionals must provide predictions of a dichotomous nature on a daily basis. Indeed, many policy questions revolve around the occurrence (or non-occurrence) of a dichotomously-phrased result: will it happen or will it not? Crisis forecasting must be defined in similar terms.

The absolute quality of crisis warning can be compromised in order to reflect more accurately the inadequacies of our forecasting capability. Whereas the appearance of a crisis has an objective probability of either unity or zero, the forecaster who lacks a perfect and deterministic model must "hedge" his or her predictions by admitting a margin of error. This is accomplished by producing probabilistic forecasts, which state clearly the likelihood of the event as approaching zero or one. Certainty is made relative by probabilities and their distances from absolutes; where uncertainty exists, it is expressed as a measurable quantity. While such forecasts often appear to be cowardly or removed from reality (e.g., a probability of precipitation of .3 or .6 is reported during a rainstorm), they represent an improvement over guesswork to the extent that they correctly and accurately identify the degree of prediction capability.

The essential goals of probabilistic crisis forecasting are: (1) a device which improves upon guesswork by providing an accurate likelihood estimate which varies on the basis of available information; (2) a device which permits dichotomous

choices--"crisis" versus "no crisis" forecasts--and improves upon the success of guesswork. In crisis forecasting, the term "guesswork" implies the rational decision to never forecast an international crisis; not only are crises infrequent, since they have a very low probability in the absence of information at any particular time in space, but they are also bureaucratically dangerous forecasts when false alarms result (e.g., Chan, 1979).

The use of information to provide probabilistic crisis forecasts is beneficial to the extent that the resulting statements of the form:

> "Y out of 100 times, a crisis occurs when information says X,"

are <u>accurate</u> over numerous observations, are <u>variant</u> across different information matrices X, and are <u>polar</u> such that Y tends to be 0 or 100. Accuracy is essential if the probabilities are to be trusted, but accuracy alone is insufficient; information can be completely useless or may be ignored--yet there is accuracy in the sense of a simple, low probability of crisis. Insisting upon variation across different information matrices results in accurate statements <u>and</u> probabilities which change as information changes. This constitutes a demand for a relationship between probabilities and information; the requirement of polarity concerns the

strength of the relationship and recognizes that the stronger (or more deterministic) the informational context regarding crisis likelihoods, the closer to absolute certainty (and utility) are the relevant forecasts.

Regarding the goal of dichotomous choices of "crisis" or "no crisis" forecasts, probabilistic forecasts which retain the three aforementioned characteristics to an acceptable degree can be entrusted to a straightforward decision-rule: whenever the probability of crisis is greater than one-half, a "crisis" forecast is rational; otherwise, a "no crisis" prediction is warranted.* The reasonableness of this rule is based upon the premise that the decisionmaker wishes to be correct more often than wrong. Whenever a crisis probability of over one-half is generated, a decisionmaker will be correct over one-half of the time and more by selecting the "crisis" forecast. Indeed, the expected rate of success is expressed as a percentage by multiplying the probability estimate by one hundred: a .6 probability equals a 60 percent success rate for crisis forecasts.

The dichotomous nature of the forecast subject--crises-- and the interval nature of the information--indicators--

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*This rule can be modified by weighting probabilities by utilities or disutilities if "false alarms" or "misses" are differentially costly. See Morrison (1974: 454).

recommends a reliance upon discriminant functions for probability estimation. Discriminant functions estimate the probability that a case belongs to a given category, such as "crisis" or "non-crisis" categories, on the basis of indicators. Discriminant analysis is the process of generating probabilistic estimates and classifications (using the .5 probability criterion) which maximize accuracy, polarity, and variation.

4.1 The Discriminant Analysis Methodology*

Figure 4-1 depicts the application of discriminant methodology within the EWAMS. The methodology can contribute to the "analytic" component by offering an internalized procedure for generating probabilities for current and future indicators, as well as for multiple-indicator information matrices. Discriminant methodology can also contribute to the automated EWAMS by offering a research tool with which to increase the performance of automated scan "advice" output and enhance the flexibility of directed scans. Machine-intensive methods thus aid and replace labor-intensive tasks.

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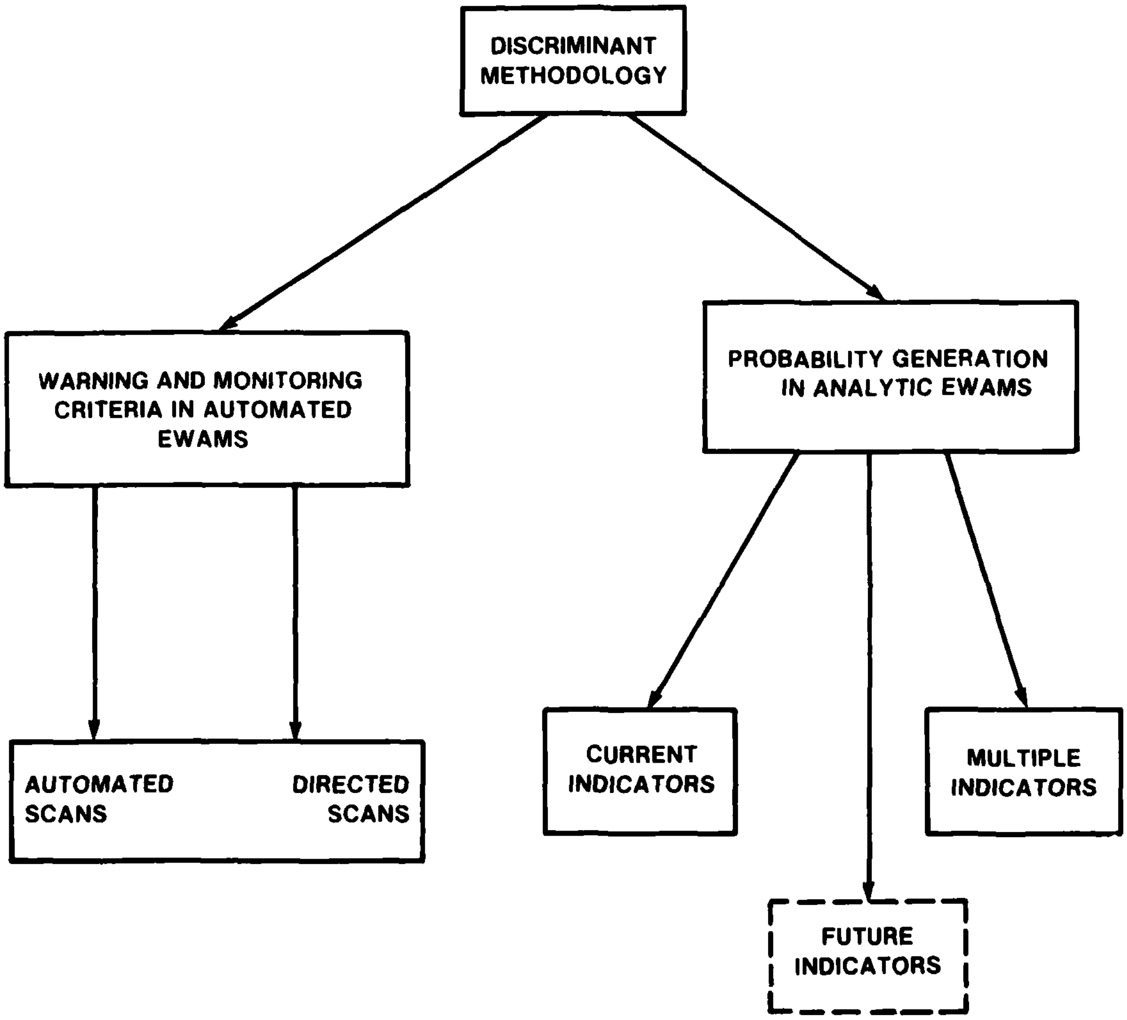
*This section is based upon Rossa (1979b: 20-23). Certain liberties are taken in order to provide a non-technical description of the analytic technique. One of these involves an assumption of a dichotomous "dependent" variable, although N-category variables are permissible (e.g., "crisis," "no crisis," "pre-crisis," "post-crisis"). Another assumption is linearity; although non-linear models can be tested, the assumption is that this would result only from research findings and recommendations which point in that direction.

Figure 4-1

DISCRIMINANT ANALYSIS METHODOLOGY
IN THE EARLY WARNING AND MONITORING SYSTEM



Discriminant analysis combines ideas from classical and Bayesian statistics in order to estimate the probability that a given case is or is not of a certain type. The "type" of case with which we are concerned is the crisis case; our cases are observations of a dyad at several time-points. Thus, discriminant analysis enables us to estimate the probability that a dyad at time t is a crisis case, or, equivalently, the probability of a crisis for the dyad at time t.* The single indicator crisis probability is estimated through a series of steps.** Using retrospective (known) data, "crisis" cases are separated from "non-crisis" cases to form two samples. The mean or "average" crisis case indicator reading is found, along with the average non-crisis case indicator level. Each mean will have an associated standard deviation, of course, and we shall assume normal distributions about the means. For each mean, we can calculate the probability of observing "x" where "x" is an indicator reading.***

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*Assume that there is no lag for simplicity in wording. With a lag of one increment, we "estimate the probability that a dyad at time t is one increment prior to a crisis, or, equivalently, the probability of a crisis for the dyad at time t + 1." With a lag, we discriminate not between "crisis" and "no crisis" time intervals, but between time-increments which are "N-lags prior to crisis" and time increments which are not.

**Multiple-indicator crisis probabilities are estimated in the same manner after they are reduced to a single "factor" or dimension, defined by the OLS multiple regression equation; e.g., they are weighted to provide a single estimate of the dependent variable and these estimates are treated as one variable.

***Technically, "x" is "any value as far, or further, from the mean as the indicator reading." The idea would not be unfamiliar to those who use significance tests.

For each case we may calculate:

- $P(x \mid c)$
- $P(x \mid n)$

where "x" is its indicator reading, "c" is the mean (and standard deviation) of the sample of crisis cases, and "n" is the mean (and standard deviation) of non-crisis cases. Note that the two probabilities need not add to one; they will do so only to the extent that the indicator is a perfect discriminator (i.e., that is has a perfect threshold value).* The calculations translate into:

- The probability of x if this is a crisis case
- The probability of x if this is a non-crisis case

These two probabilities are useful because they are required to apply Bayes' Theorem to the estimation problem. Bayes' Theorem states that:

$$P(c \mid x) = \frac{P(c) * P(x \mid c)}{P(c) * P(x \mid c) + P(n) * P(x \mid n)}$$

The term $P(c \mid x)$ is the probability that the case is a "crisis," *given* what the indicator tells us (x). Two of the other

*Actually, this holds to the extent that the relationship between indicator and crisis probability is deterministic, with no residual error. This is more strict than "a perfect threshold."

four different terms in the Bayesian formula are supplied above through classical statistics; the others, P(c) and P(n), are the a priori estimates of the likelihood of crisis or non-crisis, or the "priors," and add to one. "Priors" may be set equal, set to the proportion of cases in each category, or set by the analyst himself.*

Note that the only information required from classical statistics, and therefore from retrospective data, for the calculation of probabilities is the set of means and standard deviations which defines "c" and "n".** Given this information, any dyad for any time period can be assigned a crisis probability based on the indicator reading. The formula is established for all cases not included in retrospective data; the only required information is the new indicator value and the result is a crisis probability estimate.

Thresholds are also defined. As discussed earlier, forecasts are most efficient, by definition, when a case is placed

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*This last option might be offered to the user of the EWAMS. His or her own a priori estimate of a crisis could be obtained by asking for an estimate for the dyad and time frame which is the focus of concern. Although this is not a "true" a priori and many "pure" theorists would reject the approach as one which introduces bias, the bias operates to revise probability estimates toward the a priori of the analyst; this can be interpreted as adding user knowledge. In any event, miss and false alarm rates would signal the biasing effect to the analyst.

**Actually, two formulae are obtained; they provide, for each category (crisis, non-crisis), the z-score of the "predicted dependent variable." In this manner, multivariate situations are covered.

in a category if the probability of a correct categorization is .50 or above. Thus, if $P(c \mid x) = .50$, then indicator level "x" forecasts a crisis. Where $P(c \mid x) = .50$, "x" is the threshold value. Once categorizations are made for retrospective cases, miss/false alarm rates are reported; these can be supplied whenever the indicator is utilized in order to facilitate judgments regarding probability estimates for new cases.

Discriminant analysis is an analytical technique which provides a method of estimating the (most likely) probability of crisis, given the selected indicator(s), for a dyad at a certain time. It uses retrospective data to establish a formula for the estimate and requires a Bayesian prior; any new indicator reading will produce a probability estimate. A forecast of a crisis is warranted if the estimated probability is one-half or better, and miss/false alarm rates for the formula are based on the retrospective cases. The methodology can be utilized to establish leads/lags and automated I&W alert list generators and can be incorporated into the EWAMS for probability estimates derived from user-supplied specifications.

4.2 Monthly Probabilities

Prerequisite to tests of the discriminant analysis methodology for probabilistic crisis forecasts is the creation of a retrospective data base. This data base must constitute

a substantial sample of crisis cases and non-crisis cases (all characterized by indicators) to be employed in the EWAMS during real-time crisis monitoring and warning. The essential task of the discriminant analysis method is the identification of crisis cases within this sample through probability estimates derived from these indicators.

Crises are relatively unusual situations in interstate relations. If we define a case as an interstate dyad during a specific time period, tens of thousands of cases are available on each day, week, or month. Yet, the percentage of these which may be labeled "crisis" cases is quite low.

The selection of a sample of crisis and non-crisis cases must begin with the identification of the infrequent crisis cases in order to ensure the inclusion of a sufficient number of such cases; a simple random sample of dyads at various points in time is likely to exclude all crises. However, the task of defining crisis cases is both theoretically and operationally difficult; not only do numerous definitions of "crisis" pervade the literature of international political theory (see, e.g., Hopple and Rossa, 1980), but empirical crisis "lists" have also proliferated with a disconcerting lack of agreement (see, e.g., Thompson, 1979).

The overriding consideration in selecting a crisis inventory is the source of information which will permit analyses:

the EWAMS indicators drawn from a WEIS data set which includes all countries for all time periods since January 1, 1966. All crisis and non-crisis cases which enter the retrospective data base sample must fall within this time frame in order to utilize the indicators. Therefore, crises which occurred prior to 1966 must be excluded. Moreover, recent crises should be included in order to maximize the current relevance of the methodology; crises as late as 1978 are desirable. Finally, our crisis inventory should be as large as possible, covering all regions of the world (but excluding cases where the "crisis" label is likely to be used only when a particularistic set of criteria is employed).

These criteria focus on the requirements of crisis selection and do not concern the more difficult task of crisis dating. Theoretical and operational definitions often disagree regarding the time at which a crisis took place, even when agreement exists that a crisis did occur. The disagreements often concern the month in which the crisis began, and are almost inevitable in attempts to identify the initial day of a crisis; similar discrepancies arise regarding the end-date of a crisis. Because the Early Warning and Monitoring System seeks to warn of crises, through probabilistic forecasts, at levels of time aggregation as low as daily, the start date (day) of the crisis is the crucial parameter in a inventory.

Six available inventories of crises were studied in an attempt to isolate cases for the discriminant analysis tests. First, Daly and Bell (1977) of the Early Warning and Monitoring Project provide an inventory of fourteen crises, encompassing 27 dyads; this serves as the foundation for our analysis. This inventory meets the condition of excluding crises which occurred prior to 1966. The inventory cannot meet the requirements of recency (it includes crises through 1974) or of a daily start date (it employs monthly aggregations).

The Moore et al. (1975) report was the basis of the Daly/Bell inventory and provides start dates which are specific to the day. This list includes crises between 1946 and 1974 (inclusive) and six crises during the 1966-1974 period which were deleted by Daly/Bell because of lack of sufficient data.* However, the Moore inventory fails to cover the post-1974 period, and has been criticized because of its operational definition and dating procedures (Thompson, 1979).

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*This exclusion is based upon the usually correct tradition in social statistics of excluding cases with missing data. However, it could be argued that this tradition should not apply to events data research. Unless events are purposely excluded from the data set, we must assume that the number of events is a meaningful "zero" when none is reported. To claim a situation of "missing data" and exclude a case results in the logically unwarranted claim that numerous events have not been reported, even when some events are reported, and all event totals are incomplete. In any case, data base inadequacies will affect real time performance and, perhaps, should be anticipated in retrospective analyses.

The Daly/Bell inventory adds one case which was not in the Moore report.

The Thompson (1979) report attempts to improve upon the Moore and Daly/Bell inventories by devising a more acceptable set of operational criteria to delineate and date crises and by updating the inventory through 1977. Whereas Moore et al. (and Daly/Bell) utilize an "interaction" level of analysis in defining crises as significant departures from normal exchanges, Thompson argues in favor of a "decisionmaking" level of analysis for definitional purposes. As a result, Thompson rejects five of the fourteen Daly/Bell crises drawn from Moore, alters the start date in another three cases, and agrees with only six of Moore's nineteen crisis/dates during the period. This is not unusual, given the discrepant levels of analysis of the two inventory operationalizations. Thompson adds eleven crises to the combined inventory, nine of which began after 1974. Nevertheless, the interaction level of crisis analysis is more appropriate to the event/interaction data utilized by the EWAMS and the Thompson report is valuable only insofar as additional crises are identified; the Thompson dates and rejections of crisis cases are based upon a more circumscribed and inappropriate level of observation than that required by the EWAMS.

Two reports by researchers who focus upon a specific nation's decisional apparatus are relevant to a crisis

inventory: Hazelwood and Hayes (1976), which treats U.S. crises, and Mahoney (1978), which concerns Soviet crises in foreign affairs. These inventories are based upon decision-making definitional criteria, as is Thompson's, but are specific to one decision unit. They are therefore even less applicable to an interaction-oriented analysis. However, their value in dating crises which have been identified by more cross-national or international definitional criteria cannot be dismissed.

Finally, Butterworth (1976) offers an inventory which includes conflicts, as opposed to crises, which are managed by interstate agents. Butterworth's inventory is useful for our purposes because it is more general, featuring many situations which may represent crises, and narrative, thereby aiding the dating process. It cannot be used alone because of its lack of comprehensiveness (unmanaged crises and post-1974 crises are not included) and exclusiveness.

The shortcomings of each extant crisis inventory obviate a reliance upon a single work. An integrative strategy is therefore necessary. Table 4-1 provides an integrated crisis inventory, including dyads and start dates, and summarizes the position of each source regarding these. From 1966 through 1974 (the period covered by Moore) twenty crises are included; one of Moore's nineteen crises was rejected

Table 4-1

CRISIS LISTS: FORTY-EIGHT CRISIS DYADS, 1966-1978

	Dyads	Start Date	Sources	Comments
1.	SYR-JOR PLO-JOR	661201	Moore, Daly/Bell. Not in Butterworth, CACI, Mahoney. Thompson rejects.	Start date somewhat arbitrary, but good appoximation.
2.	USR-CHN	670111	Moore, Daly/Bell, CACI. Mahoney: 670126. Not in Butterworth. Thompson rejects.	Start date somewhat arbitrary, but good approximation. First massive demonstrations: 670126.
3.	ISR-SYR ISR-UAR ISR-JOR	670605	Daly/Bell, Mahoney, Butterworth. Moore, Thompson, CACI: 670514.	Earlier start date for alerts; later start date for war.
4.	UNK-CHN	670627	Moore. Not in Daly/Bell, CACI, Thompson, Mahoney, Butterworth.	Start date for Hong Kong dispute; first military clash on 670804.
5.	GRC-TUR GRC-CYT TUR-CYP	671115	Daly/Bell, Moore, Thompson. Not in Butterworth, CACI, Mahoney.	Start date for dispute.
6.	ISR-JOR	680102	Moore, Daly/Bell. Mahoney: 671121. Thompson rejects. Not in Butterworth, CACI.	Start date for initial fighting. Major clashes on 680125, 680321.
7.	USA-KON	680123	Moore, Daly/Bell, CACI, Butterworth, Mahoney, Thompson.	Start date for Pueblo seizure.
8.	USR-CZE	680820	Daly/Bell, Butterworth. Not in Mahoney. Moore, CACI: 680716. Thompson: 680509.	Start date for invasion.

Table 4-1

CRISIS LISTS: FORTY-EIGHT CRISIS DYADS, 1966-1978 (Cont'd.)

	Dyads	Start Date	Sources	Comments
9.	ISR-UAR ISR-SYR	690244	Moore, Daly/Bell, Mahoney, Butterworth. Not in CACI. Thompson rejects.	Start date for emergency declaration and border raid. War of Attrition one month later.
10.	USR-CHN	690302	Moore, Daly/Bell, Mahoney, Butterworth, Thompson. Not in CACI.	Start date of military clash.
11.	HON-ELS	690630	Moore, Butterworth. Not in Daly/Bell, CACI, Thompson, Mahoney.	Start date for troop concentrations.
12.	VTN-USA VTN-CAM VTN-VTS	700318	Thompson, Butterworth. Not in Daly/Bell, CACI, Mahoney, Moore.	Start date of coup. 700429, 700501 US, VTS invasion.
13.	UGA-TAZ	700709	Moore, Butterworth. Not in Daly/Bell, Thompson, CACI, Mahoney.	Start date of post-coup fighting.
14.	JOR-SYR JOR-PLO JOR-IRQ USA-SYR USA-USR ISR-SYR	700901	Daly/Bell: no Iraq. Thompson: no PLO. Moore: no PLO, Iraq. Mahoney: 700920. CACI, Butterworth.	Start date of first military, diplomatic fighting. USA, ISR, SYR actions later in month.
15.	IND-PAK	711121	Butterworth, Daly/Bell, CACI. Moore: 711127. Thompson: 710327. Mahoney: 710423.	Start date of invasion. Earlier dates closer to civil war start date.
16.	UGA-TAZ	720917	Moore, Butterworth. Not in Daly/Bell, CACI, Thompson, Mahoney.	Start date of Obote attack.

Table 4-1

CRISIS LISTS: FORTY-EIGHT CRISIS DYADS, 1966-1978 (Cont'd.)

	Dyads	Start Date	Sources	Comments
17.	RHO-ZAM	730109	Moore, Butterworth. Not in Daly/Bell, CACI, Thompson, Mahoney.	Start date of border closing after Rhodesian attacks.
18.	ISR-UAR ISR-SYR	731006	CACI, Butterworth, Daly/Bell. Moore: 731001. Mahoney and Thompson: 731003.	Start date of military attack. Early start dates for military preparations.
19.	USA-USR	731024	Butterworth, Daly/Bell. CACI: 731021. Moore: 731007. Mahoney: 731003. Thompson rejects.	Start date of global alert. Earlier start dates for Mideast War, embargo.
20.	GRC-TUR CYP-CYT	740715	Mahoney, Daly/Bell, CACI, Butterworth. Not in Moore. Thompson: 740703.	Start date of coup, civil war. Turkey invasion 740730.
21.	USA-CAM	750512	Thompson. Not in Daly/Bell, Moore, CACI, Mahoney, Butterworth.	Start date of *Mayaguez* seizure.
22.	MOR-SPN	750527	Thompson: 750428. Not in Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of war alert status.
23.	MOR-ALG	751209	Thompson: 751015. Not in Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of war preparations.
24.	SYR-LEB SYR-PLO SYR-ISR	760601	Thompson: 760106. Not in Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of invasion.

Table 4-1

CRISIS LISTS: FORTY-EIGHT CRISIS DYADS, 1966-1978 (Cont'd.)

	Dyads	Start Date	Sources	Comments
25.	ANG-COP	770310	Not in Thompson, Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of invasion of Shaba.
26.	UAR-LBY	770719	Thompson: 770326. Not in Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of military conflict.
27.	SOM-ETH	770808	Thompson: 770222. Not in Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of war situation.
28.	ISR-SYR ISR-PLO	770919	Thompson: 770602. Not in Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date (approximate) of invasion.
29.	UGA-TAZ	781031	Not in Thompson, Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of Ugandan invasion.
30.	CAM-VTN	781228	Not in Thompson, Daly/Bell, Moore, Butterworth, CACI, Mahoney.	Start date of initial armed fighting in invasion.

Table 4-1 (Cont'd.)

SIX REJECTED CRISIS DYADS, 1966-1978

	Dyads	Start Date	Sources	Comments
1.	UNK-RHO	660405	Moore. Not in Butterworth, Daly/Bell, CACI, Thompson, Mahoney.	Blockade start date. Too early for tests.
2.	ISR-LEB	670605	Moore. Not in Butterworth, Daly/Bell, CACI, Thompson, Mahoney.	Lebanon is peripheral actor.
3.	USA-KON	690415	Thompson. Not in Daly/Bell, Butterworth, CACI, Mahoney, Moore.	Plane downed, very minor incident on evidence.
4.	ISR-SYR	740822	Thompson rejects. Not in Daly/Bell, Butterworth, Moore, Mahoney, CACI.	No crisis recommendation.
5.	USA-KON	760818	Thompson. Not in Daly/Bell, Butterworth, CACI, Mahoney, Moore.	Start date of tree-trimming incident, questionable threat of war.
6.	VTN-CHN	790217	Not in Thompson, CACI, Butterworth, Daly/Bell, Mahoney, Moore.	Start date of war, past cut-off date.

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INTERNAL AND EXTERNAL CRISIS EARLY WARNING AND MONITORING.(U)
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(for reasons to become apparent); two not listed by Moore were added on the basis of evidence drawn from other sources, including the one added by Daly/Bell. Of the eighteen Moore crises, twelve are unchanged in Table 4-1. Five changes in the start dates are made:

- For the 1967 Middle East war, the start date for military engagements is chosen over the start date of military alerts. This is in accordance with Daly/Bell, Butterworth, and Mahoney, and represents a more definitive change in interactions.
- For the 1968 Soviet-Czechoslovakia crisis, the start date for the invasion is chosen over earlier estimates because of a lack of consensus regarding other dates and in accordance with Daly/Bell and Butterworth.
- For the 1971 Indo-Pakistani War, the start date is six days prior to Moore's estimate (as recommended by CACI and Butterworth).
- For the 1973 Middle East war, the start date for military attacks is selected over earlier preparatory actions in accordance with CACI and Butterworth.
- For the U.S. Global Alert of 1973, the date of the alert is chosen over a variety of earlier alternatives.

In one other case, dyads chosen by Moore for a crisis are changed; Iraq and the PLO are excluded by Moore from the 1970 Middle East crisis, but most accounts include one or both actors as central participants in the crisis.

While Moore and Daly/Bell isolate crises before 1975 and other sources are used to adjust the inventory, no

source satisfactorily covers the 1975-1978 period. Only Thompson's nine post-1974 crises are available, and these are based upon decisionmaking definitional criteria. Therefore, Thompson's list has been modified after extensive analysis of newspaper reports, as well as the Thompson documentation, utilizing the interaction level of crisis definition. As a result, seven of the post-1974 Thompson crises are included in Table 4-1, although six start dates are adjusted. One "crisis" is rejected by Thompson and is also excluded here; another (the tree-trimming incident in the Korean demilitarized zone) is rejected (despite Thompson's recommendation) because of a lack of evidence of interactional change. One crisis during the period covered by Thompson is added to his list: the Katanga rebel invasion of Zaire. We identify two 1978 crises: the Tanzanian invasion of Uganda and the Vietnamese invasion of Cambodia.

The forty-eight crisis dyads in Table 4-1 define the sample of cases which enters the following tests of discriminant analysis methodology. This analysis deals exclusively with monthly time aggregations; the target of probabilistic forecasts is the crisis-month defined as the month in which the crisis start date falls. These crisis cases are contrasted with non-crisis cases, using EWAMS indicators and predictors of case-type.

4.2.1 Cases and variables. The availability of a crisis inventory allows us to construct a data set with which the discriminant methodology may be tested. This data set is composed of (1) cases and (2) variables. These must be chosen carefully in order to test accurately the probabilistic crisis forecasting power of any methodology.

The cases which comprise the data set are of three genres:

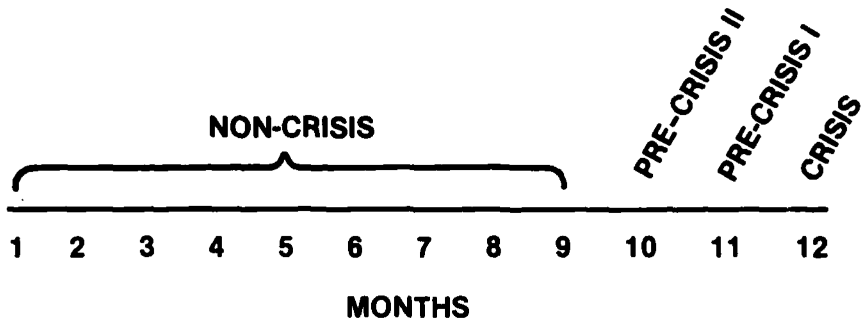
- Crisis months (as defined in the previous section)
- Precrisis months, which are those that occur prior to the crisis and which may permit crisis forecasts with a lead/lag
- Noncrisis months, which contain no crisis start date and do not immediately precede a crisis

For each crisis within our inventory, these cases are defined as depicted in Figure 4-2: two precrisis months are specified and correspond to the two months immediately preceding the occurrence of the crisis; nine noncrisis cases are defined in each case and include the nine months prior to the precrisis cases. In this manner, twelve months of data are included in the sample of cases for each of the forty-eight dyads in the inventory; the total is thus 576 cases.

The specification of two precrisis months is a procedure which facilitates testing lead/lag relationships in probabilistic forecasts; in this study, a two-increment/month lead/lag

Figure 4-2

THE TEST CASES



is the maximum for testing purposes. The selection of nine preceding months for the sample of noncrisis cases ensures that:

- Crisis months represent relatively infrequent cases in our sample, corresponding to actual frequencies of observation.
- Noncrisis months are close to the occurrence of crises in order to maximize the level of difficulty or subtlety in discrimination.
- Noncrisis months do not represent postcrisis periods and rely upon estimates of crisis end-dates.

The requirement of eleven months of data prior to a crisis obviates the inclusion of the Rhodesian Blockade case, which occurred prior to December 1, 1966.

The variables which characterize this data set are drawn from the current Early Warning and Monitoring System,

which offers ten indicators.* Unusualness (or standardized) scores of an indicator rely upon an historical reference, or "tail," to which current raw scores are compared; in this study, unusualness is measured by reference to the 5-year (60-increment) period preceding the crisis month.**

The average values of indicators in our sample and the standard deviations are reported in Table 4-2. The figures per se are revealing and anticipate the later findings. The descriptive data patterns demonstrate the vast differences among the subclasses of months within the data base. Crisis months in particular score unusually high, on the average, for every indicator. The total number of events in the mean crisis month is nearly seven times the mean for noncrisis months, and three-to-five times the average for precrisis readings. These results are most marked for conflict events and are reflected in measures of variety. Furthermore, with the exception of the cooperation Z-score, every indicator increases in value as the (average) crisis approaches; noncrisis months have the lowest scores, and precrisis I cases have the highest readings aside from crisis months. These average values suggest that the indicators increase as a crisis

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*See Daly and Davies (1978: 25-30) and Section 3.1.1 above.

**The 60-increment tail is now used for monthly and all other time aggregations in EWAMS; see Rossa (1979a) for the relevant empirical research on alternative historical tail-lengths.

Table 4-2

MEANS AND STANDARD DEVIATIONS

MEANS

	CRISIS (n = 48)	PRE-CRISIS I (n = 48)	PRE-CRISIS II (n = 48)	NO CRISIS (n = 432)	ALL (n = 576)
TOTAL ACTIVITY	27.27	7.56	5.33	3.99	6.34
TOTAL Z-SCORE	8.58	2.19	0.90	0.39	1.27
COOPERATION	6.63	2.04	1.73	1.39	1.91
COOP. Z-SCORE	4.37	0.47	0.66	0.21	0.62
CONFLICT	20.67	5.52	3.60	2.60	4.43
CONFLICT Z-SCORE	10.33	3.14	0.49	0.35	1.42
TENSION	63.96	40.92	29.10	23.26	28.61
TENSION Z-SCORE	2.75	1.79	1.48	0.20	0.57
HREL	0.42	0.23	0.17	0.13	0.17
HREL Z-SCORE	3.43	1.29	0.29	0.25	0.60

STANDARD DEVIATIONS

	CRISIS	PRE-CRISIS I	PRE-CRISIS II	NO CRISIS	ALL
TOTAL ACTIVITY	37.73	12.52	8.69	7.64	13.85
TOTAL Z-SCORE	13.41	5.21	0.39	2.27	4.65
COOPERATION	13.45	6.29	3.36	4.87	6.07
COOP. Z-SCORE	7.91	1.87	2.66	1.64	2.83
CONFLICT	29.31	8.40	6.21	5.91	10.31
CONF. Z-SCORE	18.12	6.59	1.75	2.38	5.96
TENSION	28.54	33.12	32.63	30.30	30.95
TENS. Z-SCORE	2.84	3.41	1.48	1.52	1.73
HREL	0.23	0.24	0.21	0.20	0.21
HREL Z-SCORE	4.63	2.39	1.29	1.34	1.94

approaches and that crisis and precrisis months can be distinguished unambiguously from noncrisis cases.

The standardization of indicators describes the degree of heterogeneity of cases within the sample. Large standard

deviations, which reveal heterogeneity, may render differences in means statistically insignificant in discriminant testing. Heterogeneity on all volume indicators is very high for crisis months and is also high in precrisis I months, as compared to noncrisis cases. Precrisis II cases are generally not more, or less, homogeneous than noncrisis months, but are nearly invariant on the total activity unusualness score (s = .39). Tension and uncertainty scores vary without regard to the classification scheme, but variety unusualness indicators are least homogeneous for crisis and precrisis I months.

These descriptive findings can be summarized as follows:

- Indicators of event volume and variety generally increase as a crisis approaches.
- Indicators of event volume and variety become more varied as a crisis approaches, although there are exceptions.

In anticipation of the discriminant analysis results, these findings portend both failures and successes in probabilistic forecasts. The average differences across crisis, precrisis, and noncrisis cases suggest meaningful contrasts and accurate discriminations. However, the heterogeneous nature of crisis (and precrisis) indicator readings will undoubtedly result in statistically insignificant differences and/or cases of predictive error. An analysis of current capabilities will precede a discussion of the results based on the discriminant methodology.

4.2.2 Prototype system probabilities.* The initial EWAMS probabilities were single-indicator in nature and at the ordinal level of measurement. Although the process of calculating crisis probabilities in this manner is tedious and inefficient when large numbers of indicators are available (Rossa, 1979b), a methodology which supplants this approach should equal or exceed the success rate of the established record. This record is, however, incomplete: serious tests have been limited to a relatively small sample of cases. It is therefore necessary to judge the accuracy of the current approach and utilize this measure as a standard for evaluating the discriminant analysis methodology. The requirement, then, is an analysis of probabilistic forecasts of the 48 crises in our sample, using current EWAMS capabilities.

Tables 4-3 and 4-4 supply the relevant information. The first set of figures summarizes the results of probabilistic forecasts for five indicators with an assumption of no lead/lag; all 576 months within our data set are included and classified as "crisis" months if:

- The probability is equal to or greater than .50 (for cooperation, conflict, and total activity Z-scores), or
- Tension is 70.0 or greater, or
- Hrel is .70 or greater

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*Section 3.2.1 briefly discusses the "first-stage" extrapolative methodology; see also Daly and Davies (1978).

Table 4-3

CLASSIFICATION RESULTS: EXTANT PROBABILITIES*

	HITS	MISSES	FALSE ALARMS	CORRECT REJECTIONS	SUCCESS PROBABILITY	YULE'S Q
TOTAL ACTIVITY Z-SCORE	20	28	19	509	91.8	.90
COOPERATION Z-SCORE	3	45	1	527	92.0	.94
CONFLICT Z-SCORE	22	26	25	503	91.1	.89
TENSION	28	20	73	455	83.9	.79
HREL	5	43	2	526	92.2	.94

	CLASSIFICATION SUCCESS		FORECAST SUCCESS	
	CRISIS CASES	NO CRISIS CASES	CRISIS FORECASTS	NO CRISIS FORECASTS
TOTAL ACTIVITY Z-SCORE	41.6	96.4	51.3	94.8
COOPERATION Z-SCORE	6.3	99.8	75.0	92.1
CONFLICT Z-SCORE	45.8	95.3	46.8	95.1
TENSION	58.3	86.2	27.7	96.2
HREL	10.4	99.6	71.4	92.4

*Monthly; 10-year established Z-score tail; no lag; single-indicator probabilities (cooperation, total, and conflict Z-scores) or thresholds (75.0 tension, .70 Hrel).

Table 4-4

LAGGED CLASSIFICATION RESULTS: EXTANT PROBABILITIES*

	HITS	MISSES	FALSE ALARMS	CORRECT REJECTIONS	SUCCESS PROBABILITY	YULE'S Q
TOTAL ACTIVITY Z-SCORE	7	41	12	468	90.0	.74
COOPERATION Z-SCORE	0	48	1	479	90.7	−1.00
CONFLICT Z-SCORE	10	38	15	465	90.0	.78
TENSION	14	34	23	457	89.2	.78
HREL	1	47	1	479	90.9	.82

	CLASSIFICATION SUCCESS		FORECAST SUCCESS	
	CRISIS CASES	NO CRISIS CASES	CRISIS FORECASTS	NO CRISIS FORECASTS
TOTAL ACTIVITY Z-SCORE	14.6	97.5	36.8	91.9
COOPERATION Z-SCORE	0.0	99.8	0.0	90.0
CONFLICT Z-SCORE	20.8	96.9	40.0	92.4
TENSION	29.2	95.2	37.8	93.1
HREL	2.1	99.8	50.0	90.7

*Monthly; 10-year established Z-score tail; 1-month lag; single-indicator probabilities (cooperation, total, and conflict Z-scores) or thresholds (75.0 tension, .70 Hrel).

The assumption is made that an analyst is advised to forecast a crisis if the probability for a given indicator is over one-half, because chances of a successful forecast are then over one-half. It is also assumed that an Hrel of .70 or a tension score of 70.0 is associated with a .50 probability of crisis as recommended by previous research (see, e.g., Daly and Bell, 1977).

The results report the number of: "hits" (or crisis forecasts which are correct); "misses" (or crises which were not classified as such); "false alarms" (or crisis forecasts which were incorrect); and "correct rejections" (or the correct identification of a noncrisis month).* Success Probability is the percentage of months correctly identified (as hits or correct rejections); Yule's Q is a similar measure of overall success with a maximum of 1.0. Classification Success refers to the percentage of crisis and noncrisis cases which were correctly classified: hits versus misses and correct rejections versus false alarms are compared. Forecast Success reports the percentage of classifications which are correct: hits versus false alarms and correct rejections versus misses are compared. By far the most important statistics are:

- Classification Success for crisis cases, which reports the likelihood that a crisis will be identified

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*Note that a noncrisis month includes the precrisis months when no lag is introduced.

- Forecast Success for crisis forecasts, which reports the likelihood that a crisis prediction is correct

The former becomes high as misses are avoided; the latter increases as false alarms are avoided. These are more dynamic measures of success, are highly sensitive to success/failure rates, and assess in a summary fashion the capabilities of indicators as well as the inevitable tradeoff between misses and false alarms.

The findings in Table 4-3 may be contrasted with a "rational decision model" forecasting method, which would have the following characteristics:

- No hits or false alarms
- Success Probability = 91.7 (no lag), 90.9 (1-month lag)
- 0.0% classification success for crisis cases

The model would never forecast a crisis because the a priori probability of a crisis is very low (i.e., without information gleaned from the indicators, the likelihood of a crisis is one-twelfth in our data base--one of every twelve months is a crisis month--and less in the real world). Notice that the Success Probability is high; the "no crisis" forecasts are almost always correct.

The performance of the current probabilities in the EWAMS is quite credible. The Total Activity Z-score correctly identifies over 40 percent of the crises and is more likely to "hit" than "false alarm." The Conflict Z-score is equally powerful, with a slightly better crisis classification success but a slightly lower crisis forecast success; the Conflict Z-score decreases misses at the expense of more false alarms. The Tension threshold performs credibly but is much more likely to false alarm and is inferior to the Conflict Z-score. The Cooperation Z-score and Hrel indicators miss most of the crises but seldom false alarm. The average indicator Success Probability is 90.2.

Table 4-4 uses the precrisis I month as a lagged probabilistic forecast reference point. In lagged forecasts, we attempt to distinguish between the precrisis month and the (ten previous) noncrisis months. In effect, we wish to know if a month is, or is not, a precursor to the crisis month. The 48 crisis months within the data base are expunged for such analyses because they occur after the month of concern.

In general, current EWAMS indicator probabilities perform poorly as lagged crisis warning tools. The number of "hits" is halved in most cases and the crisis classification success rate is greatly reduced. False alarms also become less frequent, but in only one case (tension) does the crisis forecast success increase, as does the overall Success Probability.

The average indicator reaches a crisis classification success of 32.7 with no lag and 13.3 with a one-month lag; average crisis forecast success similarly declines from 54.4 to 32.8. The average overall Success Probability for lagged forecasts is unchanged at 90.2, still slightly lower than a "rational decision model" which never offers a crisis forecast.

These findings can serve as a standard for comparison with the results provided through applications of the discriminant analysis methodology. As noted earlier, the methodology seeks to replace a labor-intensive approach with a machine-based method of probabilistic forecasting <u>and</u> improve forecast accuracy or, at the very least, avoid losses in accuracy. The following section reports the results of the methodological tests.

4.2.3 <u>Discriminant analysis results</u>. The most successful route to probabilistic crisis forecasting is through the use of coincident indicators which are themselves forecasted and which provide the information required for crisis warning. <u>Coincident indicators are related to crises without a lead/lag relationship; they reflect the current situation and distinguish crises from noncrisis situations only contemporaneously</u>. In practice, coincident indicators can only be used retrospectively, i.e., after the data are collected, to identify a crisis; they must be forecasted in order to provide real-time, future-oriented warnings. The coincident indicator approach

therefore requires a sophisticated indication forecast methodology as well as a crisis forecast methodology. However, if current indicators are incapable of providing advanced warning (are not leading indicators), this dual-step forecasting procedure becomes necessary. The discriminant analysis methodology provides the second step: the linking of indicators to probabilistic crisis forecasts.

Tables 4-5 and 4-6 report the results for tests which attempt to forecast crises within our data base using a coincident indicator approach. The results can be compared to Table 4-3, which also employs coincident indicators but reports results for a more limited set of probabilities (and thresholds). The tables include forecasts which are based on single-indicator probability estimates; in the discriminant analysis, each of the ten indicators is processed.

Tables 4-5 utilizes a Bayesian prior probability of crisis equal to one-half; we assume complete lack of information in the absence of indicators and, hence, an inability to choose between a "crisis" or "no crisis" forecast. Table 4-6 reports results when this prior is changed to 0.10 in order to represent or approximate the more conservative "rational" model (i.e., we assume that crises are very rare). In practice, the lower a priori will result in lower (posterior) probabilities, fewer false alarms, and more misses. A probability of .4 is unusually high given an a priori probability

Table 4-5

DISCRIMINANT CLASSIFICATION RESULTS:
EQUAL PRIOR PROBABILITIES*

	HITS	MISSES	FALSE ALARMS	CORRECT REJECTIONS	SUCCESS PROBABILITY[1]	YULE'S Q
TOTAL ACTIVITY	23	25	43	485	88.2	.82
TOTAL Z-SCORE	28	20	27	501	91.8	.93
COOPERATION	16	32	43	485	87.0	.70
COOP. Z-SCORE	22	26	36	492	89.2	.84
CONFLICT	23	25	32	496	90.1	.87
CON. Z-SCORE	21	27	21	506	91.7	.90
TENSION	36	12	156	372	70.8	.75
TEN. Z-SCORE	30	18	69	459	84.9	.84
HREL	34	14	130	398	75.0	.76
HREL Z-SCORE	25	23	56	472	86.3	.80

	CLASSIFICATION SUCCESS[2]		FORECAST SUCCESS[3]	
	CRISIS CASES	NO CRISIS CASES	CRISIS FORECASTS	NO CRISIS FORECASTS
TOTAL ACTIVITY	47.9	91.9	34.8	95.1
TOTAL Z-SCORE	58.3	94.9	50.9	96.2
COOPERATION	33.3	91.9	27.1	93.8
COOP. Z-SCORE	45.8	93.2	39.3	95.0
CONFLICT	47.9	93.9	41.8	95.2
CON. Z-SCORE	43.8	96.0	50.0	64.9
TENSION	75.0	70.5	18.8	96.9
TEN. Z-SCORE	62.5	86.9	30.3	96.0
HREL	70.8	75.4	20.7	96.6
HREL Z-SCORE	52.1	89.4	30.9	95.4

*No lag; Z-Scores: 5-year established tail, by reference to crisis month. Single indicator results, monthly data.

[1]Probability that a case or forecast is correctly identified (probability of a hit or correct rejection.)

[2]Probability that a (crisis or no crisis) case will be classified correctly.

[3]Probability that a (crisis or no crisis) forecast is correct.

Table 4-6

DISCRIMINANT CLASSIFICATION RESULTS:
10% PRIOR PROBABILITY OF CRISIS*

	HITS	MISSES	FALSE ALARMS	CORRECT REJECTIONS	SUCCESS PROBABILITY[1]	YULE'S Q
TOTAL ACTIVITY	12	36	9	519	92.2	.90
TOTAL Z-SCORE	12	36	9	519	92.2	.90
COOPERATION	4	44	6	522	91.3	.78
COOP. Z-SCORE	9	39	10	518	91.5	.85
CONFLICT	11	37	8	520	92.2	.90
CON. Z-SCORE	11	37	6	522	92.5	.93
TENSION**	0	48	0	528	91.7	—
TEN. Z-SCORE	12	36	16	512	91.0	.83
HREL	8	40	17	511	90.1	.71
HREL Z-SCORE	12	36	14	514	91.3	.67

	CLASSIFICATION SUCCESS[2]		FORECAST SUCCESS[3]	
	CRISIS CASES	NO CRISIS CASES	CRISIS FORECASTS	NO CRISIS FORECASTS
TOTAL ACTIVITY	25.0	98.3	57.1	93.5
TOTAL Z-SCORE	25.0	98.3	57.1	93.5
COOPERATION	8.3	98.9	40.0	92.2
COOP. Z-SCORE	18.8	98.1	47.4	93.0
CONFLICT	22.9	98.5	57.9	93.4
CON. Z-SCORE	22.5	98.8	64.7	93.4
TENSION	0.0	100.0	—	91.7
TEN. Z-SCORE	25.0	97.0	42.9	93.4
HREL	16.7	96.8	32.0	92.7
HREL Z-SCORE	25.0	97.3	46.2	93.5

*No lag; Z-Scores: 5-year established tail, by reference to crisis month. Single indicator results, monthly data.

**Tension results identical to always forecasting "no crisis," the rational decision given no indicator aid. Note: 91.7 success probability is a standard for comparison.

[1]Probability that a case or forecast is correctly identified (probability of a hit or correct rejection).

[2]Probability that a (crisis or no crisis) case will be classified correctly.

[3]Probability that a (crisis or no crisis) forecast is correct.

of .1, yet a "no crisis" forecast is recommended; given an a priori of .5, the same posterior probability estimate is less normal and results in the same recommended forecast.

The average indicator results are reported in Figures 4-3 and 4-4. The average indicator success probability is 2 percent lower than the current probability success rate when the prior is .5 and 1.2 percent higher when the prior is .1; Yule's Q, which also measures overall success, is slightly lower in both cases. The Crisis Classification Success and Crisis Forecast Success statistics reported in Figure 4-3 are nearly identical to those in Table 4-3: approximately 30 percent of the crises are "hit" and 54-55 percent of the forecasted crises are correct. When the Bayesian prior is reduced to .1, "false alarms" decrease and "misses" increase: nearly 50 percent of the forecasted crises occur, but 81 percent of the crises are missed. While summary measures suggest a very slight decrease in the accuracy of discriminant probabilistic forecasts, the most important indicators suggest virtually no difference when the prior probability is .5; reducing the prior to .1 results in contradictory comparisons of the summary measures and a marked change from a "false alarm" propensity to a "miss" propensity.

Reviewing the specific indicators, we may note that overall and specific success rates are generally greater for Z-scored versions of indicators; thus, the mixed findings when

Figure 4-3

AVERAGE DISCRIMINANT CLASSIFICATION RESULTS:
EQUAL PRIOR PROBABILITIES

FORECAST

DATA	**CRISIS**	**NO CRISIS**	
CRISIS	**25.8**	**21.2**	**54.9 CLASSIFICATION**
NO CRISIS	**61.3**	**467.7**	**88.4 SUCCESS**
	29.6	**95.7**	**85.7 SUCCESS PROB.**
	FORECAST SUCCESS		**.81 YULE'S Q**

Figure 4-4

AVERAGE DISCRIMINANT CLASSIFICATION RESULTS:
10% PRIOR PROBABILITIES

FORECAST

DATA	**CRISIS**	**NO CRISIS**	
CRISIS	**9.1**	**38.9**	**19.0 CLASSIFICATION**
NO CRISIS	**9.5**	**518.5**	**98.2 SUCCESS**
	48.9	**93.0**	**91.6 SUCCESS PROB.**
	FORECAST SUCCESS		**.85 YULE'S Q**

we compare Table 4-3 to Figures 4-3 and 4-4 may be a function of including additional indicators. Less general comparisons yield the following results:

- The total activity Z-score performs better overall (and better in most specific success rates) in the discriminant analysis results.
- Crisis Classification Success for the cooperation Z-score improves in discriminant analysis, but Crisis Forecasting Success is reduced for an overall reduction in performance.
- Overall, the conflict Z-score performance improves under the new methodology as Crisis Forecast Success increases greatly and Crisis Classification Success decreases slightly.
- Tension generally performs poorly overall in discriminant analysis results and tends to false alarm a great deal while seldom missing a crisis when the prior is .50.
- Hrel or uncertainty performs poorly in these results, as Crisis Classification Success increases and Crisis Forecast Success decreases.

Indicators which are not associated with probabilistic forecasting capabilities are also capable of generating crisis probabilities. These include:

- Total activity, which performs credibly in spite of a false alarm tendency (with a prior of .5).
- Cooperative activity, which has a better overall Success Probability than Hrel, but performs more weakly than most indicators.
- Conflict activity, which "hits" more crises than its Z-score version, but offers more false alarms.

* <u>Tension Z-score</u>, which is far superior to raw tension by offering fewer false alarms.

* <u>Hrel Z-score</u>, which generally outperforms its unstandardized version.

These indicators, in general, are capable of generating probabilistic crisis forecasts which are as accurate as the previous set of indicators.

The results suggest that the EWAMS can be provided with a probabilistic crisis forecasting <u>method</u> (discriminant functions) which can utilize any single indicator to generate probabilities and the utility of these probability estimates will remain at moderate-to-high levels. Moreover, the accuracy of forecasts based upon these probabilities remains strong at either of the two levels of a priori probabilities (.5 and .1).* The use of the methodology can replace the current approach to probability estimation without loss of validity and with gains in efficiency and the user may be informed regarding the trustworthiness of any probability in retrospect.** These conclusions apply to coincident

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*This is relatively meaningful if we propose to allow analyst/user input as a determinant of the Bayesian prior.

**For example, the analyst may be told of the "probability of a false alarm" and the "probability of a miss" for each indicator when the .50 probability cutoff is used retrospectively.

indicator probabilities of crisis, where current procedures are most accurate.*

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*Results for the lagged tests are not reported here; see Rossa (1979c) for this phase of the research.

5.0 COMPARATIVE SOURCE PERFORMANCE*

The work of Charles McClelland (1968, 1972), who developed the World Event Interaction Survey (WEIS) under DARPA/CTD sponsorship in the 1960s, provides a key basis for the Early Warning and Monitoring System (EWAMS). WEIS is an events data coding system which characterizes event/interactions or events in terms of an actor-initiator (who), target-recipient (whom), subject (what), and time (when). In the analytic EWAMS, the user may retrieve WEIS data from NYT and/or MAG, examine crisis probabilities, obtain tabular, graphic, and textual output, and conduct keyword searches.

The events data movement in comparative and international politics has spawned a number of source comparison studies. The major examples will be briefly surveyed here.**

In a frequently cited comparative international events analysis, Azar et al. (1972) examined the New York Times Index and a prominent regional source (the Middle East Journal) with respect to their coverage of Egyptian-Israeli relations from 1955-1958; they concluded that the two sources

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*This section is based on Hopple (1980a, 1980c).

**See especially Burgess and Lawton (1972); general findings and specific studies are reviewed in Peterson (1975) and Scolnick (1974).

differed significantly in the frequency of events reported. The regional source reported more cooperative events, suggesting that global sources may provide a distorted portrait of reality by overemphasizing the dramatic and the conflictual.

Other regional-global source comparisons have been reported in the literature on international politics (e.g., Burrowes, 1974). In addition, extensive inquiry has been undertaken to assess the relative performance of regional and global sources in the area of intranational conflict analysis. In a comparison across eleven Caribbean countries (1948-1964), Doran et al. (1973) compared Deadline Data (a global events chronology) and the Hispanic American Report; significant source differences were uncovered.*

In a more detailed study, Jackman and Boyd (1979) analyzed two Africa-specific sources (Africa Diary and African Recorder) and three global sources (New York Times Index, Keesing's Contemporary Archives, and Facts on File). They discovered that the structure of internal violence (based on factor analytic patterns) varied across sources. However, the substantive results for hypotheses concerning the determinants of collective protest and coups did not differ significantly.**

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*See also Hazelwood and West's (1974) comparison of internal conflict data for twenty Latin American nations (1955-1960).

**On the coup model, see also Jackman (1978).

Jackman and Boyd (1979: 453) offered the unexpected conclusion that "...the importance of using multiple sources and the distinction between global and regional sources is easily overstated."

The Jackman and Boyd (1979) study thus implies that the effects of source differences on research on internal African politics are not noteworthy. Their focus, however, was basic research on the determinants of internal instability. From the perspective of intelligence analysis, where there is more concern with short-term (i.e., daily or weekly) and specific phenomena, the outlook is less favorable.

For example, Cholawsky et al. (1979) compared four sources with respect to their daily coverage of the Rhodesia-Zimbabwe area:

- Foreign Broadcast Information Service (FBIS), Series for Sub-Saharan Africa, Volume VIII
- New York Times (NYT)
- Times of London (TOL)
- Christian Science Monitor (CSM)

The time frame was the period May-July, 1978.

Generally, Cholawsky et al. (1979) identified no significant differences among the four sources regarding the

proportions of violent and nonviolent stories. However, the CSM reported the fewest items and the "sample" in that source was seriously skewed. On the volume criterion, FBIS and TOL contained the largest numbers of stories. When violent incidents were broken down by target group, there were distinct variations; FBIS favored Rhodesian troops and black civilians and TOL devoted more attention to white civilians. NYT and TOL featured more balance between groups than FBIS or CSM. FBIS, TOL, and NYT appeared to be "adequate" or "good" sources; CSM was clearly "inadequate."

Aside from regional-global source comparisons, the empirical work has focused on "equivalent" sources. For example, Hill and Fenn (1974) compared NYT and the Times of London (TOL) as sources of (international) WEIS data for the three year period from 690101 to 711231.

Overall, Hill and Fenn (1974) discovered that NYT and TOL were generally consistent with respect to conflict and crisis sequences. Secondly, the newspapers exhibited different reporting styles during non-conflict periods. Thirdly, NYT tended to report more events than TOL.

Regarding the first conclusion, Hill and Fenn (1974) presented findings for four case studies:

- India-Pakistan (1971)

- Jordan-PLO (1970)
- The Middle East
- Vietnam

While NYT was more thorough in its coverage (especially of the Middle East and Vietnam), the two sources displayed analogous crisis reporting styles. For example, the distinct peaks and valleys of the Indo-Pakistani conflict showed up clearly and comparably.

Semmel (1978) profiled four U.S. elite dailies (NYT, Miami Herald, Chicago Tribune, Los Angeles Times) in terms of the amounts and types of foreign news items featured in each. Random samples (25 week-day editions) were drawn from the last three months of 1974 and 1977. The four newspapers displayed similar (although not identical) patterns.

Perhaps the most ambitious study is Gerbner and Marvanyi (1977), who examined the foreign news coverage of the daily press of different social systems. Sixty dailies in nine countries (representing the West, East, and Third World) were systematically compared for the week of May 24, 1970. Both elite and popular newspapers (as well as mass-circulation and small types) were represented for the U.S., the Soviet Union, and the seven other nations. The focus was the volume and proportion of news about the external world in each country and newspaper.

The allocation of attention to different parts of the world varied sharply by newspaper and social system; the latter differences were especially marked. In effect, the five press systems (US, Soviet Union, Western Europe, Eastern Europe, Third World) all presented unique portraits of the world. This generalization applied to both the sheer volume of news coverage and the distribution of attention to 15 world "regions." The U.S. newspapers highlighted Western Europe, Asia and the Far East, North America, and the Middle East; these four regions accounted for two-thirds of the U.S. perceptual map.

5.1 Rationale

No single newspaper or press system mirrors reality in a direct or simple fashion; Gerbner and Marvanyi (1977) emphasized quite correctly that all news systems exhibit selectivity and purpose.

However, as was pointed out in an early comparative assessment of the NYT and MAG EWAMS data sources (Hopple, 1979c: 5), a tradeoff between the goals of cost and validity must be made. The use of system-specific sources for every country in the world would yield a rich WEIS data set, but the time and cost involved preclude such an option. The reliance on a single data source, on the other hand, is a very risky strategy. No single source--even one as prestigious

as NYT--can be expected to provide a "foolproof" snapshot of all facets of international reality; biases and omissions are inevitable.*

The problem of comparing sources is compounded by the fact that there is no external, infallible standard for determining what constitutes the "real world." If we knew, for example, that Africa accounts for 7 percent of the measurable international events occurring during a given period while Western Europe initiates 12 percent of the events and receives 14 percent of the total, we could compare sources against this common, "objective" standard.** That, unfortunately, is precisely the kind of information which is unavailable.***

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*Some event data researchers have concluded that NYT is the best single source; researchers who face severe constraints of time or money may therefore be justified in relying solely on NYT. However, this argument is significantly more convincing from the perspective of basic researchers concerned with retrospective analyses of aggregate trends and patterns than it is from the vantage point of intelligence analysts whose focus is specific contexts and a current or short-term future time frame.

**In her interesting analysis of newsgathering and filtering by Times of London "gatekeepers" (i.e., home office newsmen and foreign staff correspondents and stringers), Peterson (1979) created her own universe of (hypothetical) events and elicited judgments about them in a mail questionnaire. As she noted, comparing sources "does not answer the question as to what has been systematically excluded from all sources [Peterson, 1979: 121]."

***Even if it were available, it would not negate the fact that the transitory and longer-term interests of different countries shape attention patterns (e.g., Britain's emphasis on the EEC, the U.S. awareness of Iran in 1979, etc.). To take several extreme examples, a crisis between Mongolia and China would be of less concern to the U.S. intelligence community than one in southern Africa, which in turn would not be ranked as high as a crisis between Greece and Turkey.

Thus, there is no omniscient, unbiased observer against whom both NYT and MAG can be compared. Furthermore, the envisioned role of EWAMS in the intelligence analysis or I&W (Indications and Warning) process should be explicitly recognized. The Early Warning and Monitoring System is designed to:

- Lengthen the warning lead time before serious crises of direct or indirect relevance to U.S. security interests erupt
- Systematize the information retrieval and monitoring dimensions of the I&W process
- More generally, enhance and supplement (but not replace) the judgment and intuition of the intelligence analyst

The third generalization is the most pertinent in the context of this discussion. The system is driven by the objective of aiding the human analyst in the performance of his or her tasks of monitoring and assessing incoming streams of data (the multitude of simple and complex indications) and making estimates and forecasts.

In a very fundamental sense, an I&W analyst is an (applied) empirical scientist testing hypotheses. It is a canon of scientific research that, with the soft data so typical of political and many other forms of social scientific analysis,

a multimethod or multi-indicator strategy is more likely to produce reliable, valid results.*

Jackman and Boyd's (1979) Africa data source comparison advances the argument that the impact of source variations on substantive findings (i.e., whether or not different sources yield different results in tests of hypotheses oor models) has been neglected in prior research; the focus in much of the extant work has been on simple volume comparisons. Their own research suggests that source variations do not seem to be associated with nonequivalent substantive results--at least with respect to the determinants of mass protest behavior and coups in sub-Saharan Africa.

Similar logic can be applied to the assessment of the utility of event data-based indicators in intelligence analysis. Simple volume comparisons do not necessarily warrant the inference that MAG and NYT are either equivalent or noncomparable sources.

The critical litmus tests, in fact, are the monitoring and warning indicator comparisons chronicled in the latter part of this section. The total activity, tension, and uncertainty indicators are employed here to "evaluate" the

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*See Campbell and Fiske (1959) and Hopple (1980b: ch. 2).

two sources and generate some preliminary evidence about the viability of the EWAMS dual source structure.*

Viability in this context has connotations different from those implied by classical scientific research. The latter revolves around the assessment of a model in general terms (e.g., how much of the total variance is explained? How statistically significant are the correlation coefficients or betas?, etc.). Discrepancies are often downgraded or ignored; deviant cases are treated as statistical outliers which should be removed or which might be explained more adequately in another iteration or by a more sophisticated model.

From the perspective of an intelligence analyst, however, each case is at least potentially important and incongruities become critical. When nothing is happening (i.e., neither source indicates unusual or noteworthy activity) and this can also be verified by other data streams, the analyst is justified in a no-crisis forecast (i.e., a correct rejection). When both (and perhaps other) sources converge on a warning, a crisis forecast is more credible (i.e., the system "hits").

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*Probabilities, Z-scores, and other EWAMS indicators (e.g., CAP, Special Purpose Indicators, etc.) could have been added to the design but would have increased the complexity of the analysis considerably. As the discussion below should establish, the data and indicators surveyed here should be sufficient for the purpose of assessing the general utility of a dual (or multiple) source approach.

The other two states of affairs--misses and false alarms--are of course much more problematic.

A dual- or multi-source system quite clearly exhibits an increased potential for false alarming (as does a multi-indicator, single source system). Generally, however, false alarms are preferred over misses.

The reasoning which underlies this preference can be illuminated by drawing on an example from research on psychophysiology and biocybernetics. In the extended quotation below from Donchin (1979), brackets are employed to insert material which relates to the intelligence analysis and crisis warning processes.

> Consider an operator [or I&W analyst] presented with a series of items which he must classify as belonging to one of two categories [e.g., crisis or not-crisis]. The large marjority of the items [or discrete events] with which he is presented are not important [i.e., constitute the ongoing and normal stream of events]. However, randomly interspersed within this series of neutral items are important items which must be properly classified [i.e., monitoring and warning situations]. One can imagine a number of such examples, ranging from the detection of defects in prescription pills on a production line through the identification of enemy aircraft from amongst other signals on a radar screen. In the example I shall describe, the operators were presented on the cathoderay tube screen of a computer terminal with a series of names, 80% of which were female names, 20% male names. Their task was to press a button with one hand on the appearance of a male name, and with the other hand on the appearance of a female name.
>
> . . . .
>
> It occurred to us that it may be possible to incorporate a biocybernetic error-correction algorithm

in a system that would allow subjects to respond as fast as they wished while allowing the computer to correct for errors using an algorithm based on P300. . . Whenever "thought" preceded action (as it presumably does whenever P300 latency is shorter than reaction time), the subject tended to be correct. This interpretation of the data suggests that it should be possible to identify the trials in which the subject erred by evaluating the difference between reaction time and the P300 latency. McCarthy, Jutas, and Donchin (in preparation) developed such an error-correcting biocybernetic algorithm and applied it to the data obtained from the ten subjects that were assigned the task of discriminating between male and female names. Briefly, this decision-aiding procedure operated as follows. Whenever the subject gave an "important" response, the item was accepted as "important." If the subjects make a "neutral" response, the EEG was examined for the presence or absence of the P300. If P300 was absent, the trial was accepted as neutral. Those trials on which the subjects responded "frequent," but which were identified as containing a P300 by the first tier of the analysis, were subjected to further analysis in which the latency of the P300 was compared to the reaction time obtained on that trial. If reaction time was longer than P300 latency, the trial was accepted as neutral. That is, the subject's response was accepted as valid. However, if reaction time was shorter than P300 latency, the trial was considered to be a candidate for a misclassified "important" item. A third analysis was then conducted which utilized information about differences in waveform between correctly and incorrectly classified rare trials. Following this third tier of the analysis, some trials were considered to be definitely "important" and the rest were accepted as neutral.

The efficacy of this procedure can be evaluated as follows. Its benefits consist of all the important trials that were classified by the subject's response as neutral but were reclassified by the biocybernetic algorithm as important. Those are, in fact, the errors corrected by the biocybernetic algorithm ["misses," in EWAMS terminology]. The cost consists of neutral trials which were classified correctly by the subject, but which the algorithm now considers important. The results obtained for the ten subjects show a very substantial benefit. In fact, most of the errors committed by the subjects were retrieved by the algorithm, albeit at the cost of increased errors in classifying the frequent items. Of course, in any such procedure, the costs and benefits must be evaluated in relation

> to the specific task. The absolute number of misclassified "frequents" following the algorithm is very large. The absolute number of retrieved "important" items is relatively small. If, however, it is the case, and we believe it often is, that in such tasks the operator's main responsibility is to avoid misclassifying the important items, then the cost-benefit analysis performed suggests that a substantial improvement in the system's performance is gained by the incorporation of the biocybernetic error-correcting code. [Emphasis added]

Similarly, in intelligence analysis, the central goal is to "avoid misclassifying the important items." This means that misses, when a crisis is misclassified as a routine situation or noncrisis, should be avoided despite the fact that such a goal will be accompanied by an increase in the number of false alarms (analogues to neutral trials incorrectly considered to be important).

In the I&W process, then, an identical cost-benefit configuration is desirable. Crisis forecasting is one of those situations in which the object of concern is very rare (i.e., the absolute number of retrieved "important" items can be expected to be relatively small in any case); clearly, however, the "operator's" main responsibility is the avoidance of misses.

5.2 Analytic I&W

This section presents empirical data from the MAG and NYT sources for the first six months of 1979. Earlier source

comparisons (e.g., Hopple, 1979b, 1979c) were limited to the three months of October, November, and December, 1978. In addition to extending the time frame, this analysis also avoids the potentially confounding impact of the switch from the Times of London or TOL (used in October and November of 1978) to MAG (the source for December, 1978).* Thus, the NYT-MAG comparison for the last three months of 1978 actually involved NYT and TOL for the first two months and NYT and MAG for the third. This January-June, 1979 assessment compares NYT and MAG for all six months.

5.2.1 Aggregate results. Overall totals for the two newspapers are presented in Table 5-1. For the six-month period from 790101 to 790630, NYT contained 2243 discrete event/interactions and the MAG total was 2249. On a monthly basis, the deceptive nature of these very similar grand totals is clearly revealed.

For example, NYT yielded 356 events in January of 1979 and MAG produced only 266. During the next month, the comparable Ns were 492 and 409. NYT was slightly ahead of MAG in April (296 to 273) and May (339 to 320). MAG totals exceeded those for NYT in two months: March (516 for MAG and 457 for NYT) and June (465 and 303 for MAG and NYT, respectively).

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*The TOL labor strike began in December of 1978.

Table 5-1

TOTAL VOLUME: JANUARY-JUNE, 1979[a]

	TOTAL		COOP		CON	
	NYT	MAG	NYT	MAG	NYT	MAG
790101	356	266	227	180	129	86
790201	492	409	305	223	187	186
790301	457	516	284	254	173	262
790401	296	273	165	101	131	172
790501	339	320	231	206	108	114
790601	303	465	190	307	113	158
Total	2243	2249	1402	1271	841	978

[a]Coop=cooperation; con=conflict; NYT=New York Times; MAG=Manchester Guardian.

As the standard WEIS event list in Table 5-2 shows, the dichotomies of cooperation and conflict can be broken down into 22 discrete event-interaction categories; 10 are cooperative in nature and 12 conflictual. The 22 categories range from yield to force. A variety of verbal and physical forms of behavior constitutes the 22 general and 63 specific WEIS coding categories.

Source differences emerge immediately when the NYT and MAG event frequency breakdowns are displayed (see Table 5-3). Highlighted in both data sets are the categories comment, consult, agree, accuse, and force. However, it is clear that the actual event-interactions are far from identical. At the extreme ends of the "continuum," both yield and force acts should be fairly straightforward and easily codable; their levels of reliability should consequently be higher than the

Table 5-2

THE WEIS EVENTS CODING SCHEME

1. YIELD
   - 011 Surrender, yield to order, submit to arrest, etc.
   - 012 Yield position, retreat, evacuate
   - 013 Admit wrongdoing, retract statement
2. COMMENT
   - 021 Explicit decline to comment
   - 022 Comment on situation-pessimistic
   - 023 Comment on situation-neutral
   - 024 Comment on situation-optimistic
   - 025 Explain policy or future position
3. CONSULT
   - 031 Meet with, at a neutral site, or send note
   - 032 Visit, go to
   - 033 Receive visit, host
4. APPROVE
   - 041 Praise, hail, applaud, condolences
   - 042 Endorse other policy or position, give verbal support
5. PROMISE
   - 051 Promise own policy support
   - 052 Promise material support
   - 053 Promise other future support
   - 054 Assure, reassure
6. GRANT
   - 061 Express regret, apologize
   - 062 Give state invitation
   - 063 Grant asylum
   - 064 Grant privilege, diplomatic recognition, de facto relations, etc.
   - 065 Suspend negative sanctions, truce
   - 066 Release and/or return person or property
7. REWARD
   - 071 Extend economic aid
   - 072 Extend military assistance
   - 073 Give other assistance
8. AGREE
   - 081 Make substantive agreement
   - 082 Agree to future action or procedure, agree to meet, to negotiate
9. REQUEST
   - 091 Ask for information
   - 092 Ask for policy assistance
   - 093 Ask for material assistance
   - 094 Request action, call for
   - 095 Entreat, plead, appeal to
10. PROPOSE
    - 101 Offer proposal
    - 102 Urge or suggest action or policy
11. REJECT
    - 111 Turn down proposal, reject protest demand, threat, etc.
    - 112 Refuse, oppose, refuse to allow
12. ACCUSE
    - 121 Charge, criticize, blame, disapprove
    - 122 Denounce, denigrate, abuse
13. PROTEST
    - 131 Make complaint (not formal)
    - 132 Formal complaint or protest
14. DENY
    - 141 Deny an accusation
    - 142 Deny an attributed policy, action, role or position
15. DEMAND
    - 150 Issue order or command, insist, demand compliance, etc.
16. WARN
    - 160 Give warning
17. THREATEN
    - 171 Threat without specific negative sanctions
    - 172 Threat with specific negative sanctions
    - 173 Threat with force specified
    - 174 Ultimatum, threat with time limit and negative sanctions specified
18. DEMONSTRATE
    - 181 Nonmilitary demonstration, walk-out on
    - 182 Armed force mobilization, exercise and/or display
19. REDUCE RELATIONSHIP
    - 191 Cancel or postpone event
    - 192 Reduce routine international activity, recall officials, etc.
    - 193 Reduce economic aid or military assistance
    - 194 Halt negotiations
    - 195 Break diplomatic relations
20. EXPEL
    - 201 Order personnel out of country
    - 202 Expel organization or group
21. SEIZE
    - 211 Seize position or possessions
    - 212 Detain or arrest person(s)
22. FORCE
    - 221 Noninjury destructive act
    - 222 Nonmilitary injury/destruction
    - 223 Military engagement

Table 5-3

NYT-MAG EVENT FREQUENCIES: JANUARY-JUNE, (1979)

Monthly Cooperative Activity Source: NYT
790101 - 790630

*** wor <<<<<< Two-Way Flow >>>>>> wor ***

Date	YLD	CMNT	CNSL	APPR	PRMS	GRNT	REWD	AGRE	RQST	PROP
790101	1	114	32	15	7	15	7	10	9	17
790201	0	123	58	6	13	10	11	23	16	37
790301	4	100	70	10	13	0	13	33	4	29
790401	2	70	36	4	1	12	2	17	8	13
790501	3	72	66	12	9	10	4	26	6	23
790601	0	52	99	4	4	10	3	22	12	24

Monthly Cooperative Activity Source: MAG
790101 - 790630

*** wor <<<<<< Two-Way Flow >>>>>> wor ***

Date	YLD	CMNT	CNSL	APPR	PRMS	GRNT	REWD	AGRE	RQST	PROP
790102	0	30	49	15	16	11	2	23	8	10
790201	2	42	59	7	12	12	10	21	37	21
790301	0	35	68	8	14	11	12	32	41	33
790402	0	7	43	6	6	14	4	4	11	6
790501	2	21	86	13	11	14	2	31	14	12
790601	2	25	117	10	12	10	5	73	21	24

Monthly Conflictual Activity Source: NYT
790101 - 790630

*** wor <<<<<< Two-Way Flow >>>>>> wor ***

Date	RJCT	ACUS	PROT	DENY	DMND	WARN	THRT	DEMO	RDUC	EXPL	SEIZ	FRCE
790101	4	45	3	4	6	22	3	5	2	1	3	31
790201	0	65	0	9	3	27	0	0	8	2	9	40
790301	15	63	5	10	5	17	3	3	0	2	5	37
790401	5	30	6	6	2	14	2	5	19	4	4	26
790501	9	44	1	6	1	6	1	2	10	2	5	21
790601	15	36	3	6	2	12	0	1	3	2	2	23

Monthly Conflictual Activity Source: MAG
790101 - 790630

*** wor <<<<<< Two-Way Flow >>>>>> wor ***

Date	RJCT	ACUS	PROT	DENY	DMND	WARN	THRT	DEMO	RDUC	EXPL	SEIZ	FRCE
790102	0	30	0	1	2	4	6	7	3	1	2	22
790201	11	71	13	11	5	12	8	5	5	3	10	32
790301	19	105	17	11	4	14	17	19	24	3	4	25
790402	4	33	10	11	3	12	7	4	29	8	9	34
790501	16	32	10	4	3	9	1	3	10	0	2	24
790601	10	55	13	5	12	9	6	6	9	0	5	28

other categories. It is therefore instructive to compare NYT and MAG with respect to simple monthly frequencies of yields and acts of force:

	Yield		Force	
Date	NYT	MAG	NYT	MAG
790101	1	0	31	22
790201	0	2	40	32
790301	4	8	37	25
790401	2	0	26	34
790501	3	2	21	24
790601	0	2	23	28

Assuming that the yield and force categories are very reliable (at least compared to more ambiguous types of international behavior--i.e., if a yield or force event is reported, the data collector will have little or no problem identifying and coding it), then the discrepancies displayed above suggest that NYT and MAG contain a significant amount of nonoverlapping material. Both sources show that yields are rare; however, MAG reports none in January while NYT contains 1, NYT has none for February while MAG reports 2, and so forth. The totals are different for all six months. The same holds for force, with NYT exceeding MAG during the first three months and the Guardian showing more acts of force during April, May, and June.

The lack of equivalence recurs throughout Table 5-3. Especially noteworthy is the difference between comment totals, with NYT consistently yielding more comments than

MAG (e.g., 114 versus 38 in January, 123 versus 42 in February, etc.). Other salient variations include:

- Consult (June, 1979: 59 for NYT and 117 for MAG)
- Agree (June, 1979: 22 for NYT and 73 for MAG)
- Accuse (March, 1979: 63 for NYT and 105 for MAG)
- Demonstrate (March, 1979: 3 for NYT and 19 for MAG)

The significance and implications of these variations can be easily exaggerated and misinterpreted. For example, the lack of identity at this very global (world-world) level of scanning may conceal a considerable amount of similarity at lower levels of analysis. The comparison of overall totals in this fashion does not permit a direct assessment or even a reasonable indirect estimate of the actual amount of overlap in the two data sets.

Furthermore, it is entirely possible that MAG and NYT may perform similarly at the country pair level and especially in situations of high tension and severe conflict and crisis. This was the general conclusion, it should be emphasized, in Hill and Fenn's (1974) three-year comparison of NYT and TOL WEIS data. The focus will therefore shift to a less global level of analysis in the following section.

5.2.2 Country-to-world results. Analyses of country-to-world interaction profiles are presented in this section. Marshall Pulley of the EWAMS computer science staff developed special standalone software which was used on the Demonstration and Development Facility's PDP 11/70 minicomputer to produce event frequencies for each country in the world for the period 790101-790630.* Both cooperative and conflictual activity levels and events initiated and received were combined; the results, presented in Table 5-4, therefore consist of all events sent from and received by every country and other WEIS actor during the first half of 1979.

Thus, NYT reported a total of 824 events for the U.S. (initiator and recipient); the corresponding MAG total was 527. Table 5-4 reveals that NYT tends to report more events for certain actors and MAG yields larger totals for others.

Of 146 actors, the MAG volume is greater in 90 instances; the NYT total is larger than (or equal to) MAG in 56 cases. Especially noteworthy differences can be isolated systematically by listing those countries for which NYT exceeded MAG by 5 or more events and vice versa.

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*The Demonstration and Development Facility is DARPA/CTD's computer facility, where all EWAMS analyses are performed on the on-site 11/70.

Table 5-4

EVENTS SENT AND RECEIVED BY COUNTRY:
JANUARY-JUNE (1979)

EVENTS FREQUENCY
Cooperative and Conflictual

790101 - 790630

Initiator and Recipient	Frequency NYT	Frequency MAG	Initiator and Recipient	Frequency NYT	Frequency MAG
usa	824	527	san marino	2	0
canada	13	25	malta	0	1
cuba	27	23	albania	0	3
haiti	2	0	yugoslavia	15	29
jamaica	0	6	greece	7	10
trinidad and tobago	0	1	cyprus/greek	16	16
barbados	0	3	cyprus/turkish	13	10
grenada	4	11	bulgaria	1	9
mexico	10	12	rumania	5	11
el salvador	1	1	ussr	283	254
nicaragua	32	12	finland	2	5
costa rica	4	0	sweden	2	4
panama	3	0	norway	7	3
columbia	1	0	denmark	0	11
venezuela	7	3	warsaw pact	3	1
guyana	0	1	iceland	0	1
ecuador	1	0	nato	10	15
peru	0	1	eec	11	67
brazil	0	4	intl org (un, etc)	165	139
chile	10	6	senegal	1	1
argentina	2	4	mauritania	3	7
oas	11	7	ivory coast	0	1
united kingdom	44	259	guinea	0	1
ireland	3	6	ghana	1	3
netherlands	1	14	nigeria	0	2
belgium	4	6	central african rep	5	5
luxemburg	0	1	chad	4	3
france	42	77	zaire (congo-kinshasa)	0	10
switzerland	0	3	uganda	67	79
spain	7	21	kenya	2	11
portugal	6	5	tanzania	55	59
germany/fed rep	33	72	burundi	1	0
germany/dem rep	10	0	rwanda	0	4
berlin/west	1	6	somalia	3	6
poland	6	0	djibouti	1	2
austria	1	7	ethiopia	3	14
hungary	4	5	eritrean liberation front	5	4
czechoslovakia	1	6	zambia	2	32
italy	5	25	rhodesia	64	124
vatican	14	7	zimbabwe-rhodesia lib. org.	34	62

Table 5-4

EVENTS SENT AND RECEIVED BY COUNTRY:
JANUARY-JUNE (1979) (Cont'd.)

EVENTS FREQUENCY
Cooperative and Conflictual

790101 - 790630

Initiator and Recipient	Frequency NYT	Frequency MAG
frelimo-mozambique lib. org.	4	10
swapo	0	11
south africa	49	69
angola	6	22
namibia	16	21
namibian national front	0	1
lesotho	0	1
botswana	1	6
oau	7	4
morocco	5	12
algeria	2	5
tunisia	2	4
libya	10	39
sudan	4	6
iran	113	93
turkey	19	15
kurdistan	4	10
iraq	16	35
egypt	251	237
syria	40	47
lebanon	63	26
lebanese christians	0	26
lebanese moslems	0	12
jordan	8	15
israel	354	283
saudi arabia	44	45
united arab emirates	4	5
yemen	38	31
southern yemen	45	37
kuwait	9	16
org arab petr export countries	0	2
org of petro export countries	6	5
bahrain	0	2
qatar	1	5
palestine liberation org.	149	189
oman	7	3
arab league	29	15
afghanistan	12	23
china, peoples rep	314	248
china, rep of	24	0

Initiator and Recipient	Frequency NYT	Frequency MAG
hong kong	10	10
macao	2	0
korea/north	20	20
korea/south	27	22
japan	41	64
india	35	21
bangladesh	4	0
pakistan	20	80
burma	4	0
sri lanka (ceylon)	0	1
maldive	1	0
thailand	32	40
cambodia	40	66
laos	7	20
socialist rep of vietnam	280	132
vietnam/south	0	46
malaysia	19	20
singapore	5	21
philippines	11	16
indonesia	7	15
tibet	0	1
australia	3	15
papua new guinea	2	0
new zealand	1	7
multilateral groups	244	46
not stated, unidentified trgt	51	10

Using this criterion, NYT's volume was "significantly" higher for 24 countries. These include the USA itself, the USSR, Iran, the Koreas, the Chinas, Vietnam, India, and Pakistan. When the Middle EAstern actors on the list (UAR, Lebanon, Israel, Yemen, South Yemen, the PLO, and the Arab League) are taken into account, it is clear the NYT tends to favor the three superpowers as well as prominent dyads from the Cold War era (China and Taiwan, North and South Korea, India and Pakistan) and the Middle East. The Camp David period of late 1978 and its protracted aftermath undoubtedly account at least in part for the salience of Egypt and Israel.

Whereas the NYT total is greater than MAG's 24 times, the MAG source exceeds NYT's total by 5 or more events in the case of 50 actors. Quite clearly, MAG's attention is more dispersed and less focused on "key actors." Generally, the analyst interested in smaller countries would be advised to consult the Guardian.

Aside from the United Kingdom itself, the Guardian pays more attention to former British colonies (with the significant exceptions of India and Pakistan). Among these are Canada, Jamaica, and Grenada in the Western Hemisphere, a number of former African colonies (Uganda, Kenya, Zambia, Rhodesia, South Africa), and Singapore.

In addition, MAG features Western Europe much more than NYT does (including Austria, Italy, Denmark, the EEC, the Netherlands, France, Spain, and even West Germany). Surprisingly, West Berlin also makes this list, as do several Eastern European nations (Czechoslovakia, Yugoslavia, Bulgaria, and Rumania). In contrast, only one European country (aside from the Soviet Union) appears on the NYT list: Switzerland.

MAG also devotes significantly more attention to Africa and other parts of the Third World. In addition to the ex-colonies in sub-Saharan Africa, MAG reports significantly greater numbers of events for both former Portuguese colonies (Angola and Mozambique) as well as for Zaire, Ethiopia, the Zimbabwe Liberation Front, and Botswana.*

In the Middle East, the following countries are represented on the MAG list: Morocco; Libya; Iraq; Syria; Jordan; and Kuwait. Also, three subnational actors in the volatile Middle East receive more emphasis in MAG than NYT: the Kurds and the Lebanese Christians and Moslems.

Afghanistan, Cambodia, Indonesia, and even the U.S. ally Thailand and the former U.S. colony the Philippines join Singapore as countries which elicit more coverage from the

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*Until early 1980, the Zimbabwe code was used for the anti-Rhodesia liberation forces; it is now used as the code for the country and the Rhodesia code is no longer employed.

Guardian than from NYT. Finally, Japan's MAG activity level surpasses the corresponding NYT total.

The greater U.S. emphasis on its superpower colleagues and the generally more concentrated nature of NYT's coverage are both confirmed by other research.* Even Latin America is relatively neglected by NYT; only Mexico and the fairly recent hotspot Nicaragua are represented among the 24 actors for which the *Times* exceeds the *Guardian* by 5 or more events.

5.2.3 Country pair results. NYT versus MAG comparisons for 9 selected country pairs are featured in Tables 5-5 (activity) and 5-6 (tension and uncertainty). These dyads include ones which are almost invariably prominent in world affairs (US-USSR; US-China; China-USSR; Israel-UAR) as well as recent crisis pairs (Iran-USA; Uganda-Tanzania; China-Vietnam) and two centers of ongoing hostility and "permanent crisis" (Rhodesia-Zimbabwe and Israel-PLO).**

As Table 5-5, which profiles total activity, cooperation, and conflict patterns, shows, there are only 12 out of 54 volume comparisons which go above the "significance" criterion of 10. The most noteworthy of these include the U.S. and China

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*See, e.g., Semmel's (1978) previously mentioned comparison of U.S. elite newspapers.

**The "permanent crisis" designation, of course, applies to Rhodesia-Zimbabwe from the 1960s up until recently.

Table 5-5

SELECTED COUNTRY PAIR ACTIVITY LEVELS: JANUARY-JUNE, 1979[a]

	TOTAL		COOP		CON	
	NYT	MAG	NYT	MAG	NYT	MAG
(1) usa-usr						
790101*	32	7	23	7	9	0
790201	28	23	12	12	16	11
790301*	20	9	12	4	8	5
790401*	24	13	18	8	1	1
790501	19	9	18	8	1	1
790601	21	17	15	13	6	4
(2) usa-chn						
790101*	30	2	30	2	0	0
790201	16	14	12	1	4	2
790301	7	4	7	4	0	0
790401	6	4	5	3	1	1
790501	11	6	10	5	1	1
790601	3	1	3	0	0	1
(3) chn-usr						
790101	5	0	0	0	5	0
790201	9	10	2	1	7	9
790301	9	16	0	1	9	15
790401	5	2	0	0	5	2
790501	1	3	0	2	1	1
790601	3	4	1	2	2	2
(4)isr-uar						
790101	11	11	6	8	5	3
790201	9	13	6	9	3	4
790301*	25	11	19	8	6	3
790401	24	15	21	9	3	6
790501	15	26	10	19	5	7
790601	14	18	13	16	1	2
(5) rho-zim						
790101	3	6	2	1	1	5
790201	12	18	3	3	9	15
790301	6	5	1	1	5	4
790401	6	12		0	5	12
790501	0	1	0	0	0	1
790601	2	8	0	0	2	8
(6) irn-usa						
790101	14	6	12	3	2	3
790201*	21	8	21	5	5	3
790301	5	7	5	2	0	5
790401	2	3	1	0	1	3
790501	1	5	2	0	4	5
790601	4	3	1	0	3	3
(7) uga-taz						
790101	4	4	0	0	4	4
790201	14	16	3	1	11	15
790301	10	14	6	4	4	10
790401	16	4	2	0	14	4
790501	0	0	0	0	0	0
790601	2	2	2	2	0	0
(8) chn-utn						
790101*	16	3	3	0	13	3
790201*	44	26	7	2	37	24
790301	34	37	14	9	20	28
790401*	19	8	10	6	9	2
790501*	12	24	4	7	8	17
790601	16	7	9	3	7	4
(9) isr-plo						
790101*	20	9	3	1	17	8
790201	4	2	3	1	1	1
790301	10	8	3	2	7	6
790401	20	18	6	2	14	16
790501	26	18	6	0	20	18
790601	15	12	3	1	12	11

*Totals differ by more than 10 events.
[a]See Note a, Table 4.

Table 5-6

SELECTED COUNTRY PAIR TENSION AND H-REL SCORES: JANUARY-JUNE, 1979[a]

	TENSION		H-REL	
	NYT	MAG	NYT	MAG
(1) usa-usr				
790101	27*	0*	.47	.41
790201	55	46	.62	.70
790301	38*	49*	.45	.46
790401	24	21	.51	.51
790501	5	10	.49	.46
790601	27	22	.60	.68
(2) usa-chn				
790101	0*	20*	.40*	.22*
790201	23	13	.54	.60
790301	0	0	.44*	.22*
790401	14	19	.33	.34
790501	8	14	.38*	.51*
790601	0*	28*	.21*	0*
(3) chn-usr				
790101	80*	0*	.31*	0*
790201	69*	81*	.34	.44
790301	89	88	.28	.27
790401	80*	50*	0*	.22*
790501	28	22	0*	.21*
790601	44	38	.21	.22
(4) isr-uar				
790101	41*	25*	.32	.25
790201	30	28	.28*	.53*
790301	23	25	.62	.57
790401	12*	37*	.49	.51
790501	31	26	.69	.63
790601	7	11	.36*	.60*
(5) rho-zim				
790101	22*	69*	.21*	.40*
790201	69	79	.53	.44
790301	69	64	.15	.16
790401	69*	92*	.15*	.40*
790501	0	28	0	0
790601	50*	88*	0*	.24*
(6) irn-usa				
790101	0*	42*	.41	.51
790201	19*	33*	.61	.62
790301	0*	61*	.16*	.63*
790401	25*	67*	.22*	.36*
790501	56*	80*	.33	.43
790601	56*	67*	.45	.36
(7) uga-taz				
790101	75	75	.22*	.34*
790201	73*	88*	.50	.47
790301	36*	66*	.31*	.65*
790401	82	75	.47*	.34*
790501	0	0	0	0
790601	0	0	0	0
(8) chn-unt				
790101	76	67	.49*	.21*
790201	82	89	.45	.53
790301	57*	73*	.59*	.73*
790401	45*	22*	.58	.54
790501	61	68	.40*	.63*
790601	41	49	.51	.41
(9) isr-plo				
790101	81	79	.45*	.11*
790201	19	25	.18	.22
790301	63	66	.52*	.29*
790401	67*	84*	.60*	.34*
790501	74*	94*	.47*	.27*
790601	75	84	.31*	.09*

*Scores differ by more than 10 (tension) or .10 (H-rel).

[a]NYT= _New York Times_; MAG= _Manchester Guardian_.

in January (30 events from NYT and only 2 from MAG), Iran and the U.S. in February (26/NYT and 8/MAG), and China-Vietnam (16/NYT and 3/MAG in January; 44/NYT and 26/MAG in February).

This pattern clearly implies that source differences may be minimized at the level of active and/or crisis-prone country pairs, a conclusion that is buttressed by Hill and Fenn's (1974) NYT-TOL analysis. However, the results for both tension and H-rel (Table 10) are somewhat less encouraging.

For tension, 23 of the 54 scores vary by more than 10 points. Especially deserving of attention are Rhodesia-Zimbabwe and Iran-U.S.; for both pairs, MAG tension scores tend to be appreciably higher than NYT scores (particularly for the former pair in January, April, and June and the latter in the last four months of the period). For Iran-USA, in fact, MAG forecasts a crisis in May and depicts a relationship of consistently higher tension throughout the period.

Instances when only MAG or NYT data cross the monitoring or warning tension threshold can be illuminated. There are 12 pairs which conform to this pattern:

Month	Pair	NYT	MAG
790101	chn-usr	80	0
790201	"	69	81
790401	"	80	50
790101	rho-zim	22	69
790401	"	69	92
790601	"	50	88

790301	irn-usa	0	61
790401	"	25	67
790501	"	56	80
790301	uga-taz	36	66
790301	chn-vtn	57	73
790401	isr-plo	67	84

In 8 of these 12 instances, one source forecasts a crisis (i.e., surpasses the threshold of 70) while the other does not. The most striking examples include China and the Soviet Union in January and Iran and the U.S. in May.

Of the 54 H-rel or uncertainty comparisons, there are 25 differences greater than the absolute value of .10. Many of these are technically but perhaps not "meaningfully" significant. However, note the .28 and .53 (February) and .36 and .60 (June) for Israel and the UAR.* The Iran-U.S. scores for March are also distinctive (.16/NYT and .63/MAG); both tension and H-rel generated monitoring advice from MAG but not NYT during the month of March.**

The tension and uncertainty score configurations both illustrate the utility of a dual source warning and monitoring

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*The EWAMS indicators have been used primarily for tracking and forecasting severe crises (i.e., episodes of hostility and conflict which may escalate into serious violence or war). However, there is some evidence that the uncertainty indicator is also useful for profiling the dynamics of "hard bargaining" between former enemies (i.e., situations of protracted enmity which are evolving into detente relationships).

**This is one of the few situations in which both core indicators from source A signal a "watch" (i.e., monitoring) or crisis warning while neither indicator from source B does.

system. In the typical basic research analytical endeavor, these very specific differences would be of less concern; in the context of a system which has been designed for transfer to a "user community" of intelligence analysts, the case-specific discrepancies which have surfaced assume much more significance.

5.3 Automated I&W

A series of real-time tests and analyses of the Early Warning and Monitoring System (EWAMS) is currently in progress. Central to this task is the question: how does the EWAMS perform in a current, real-time mode? Using EWAMS data, indicators, and probabilities for projection (one week into the future) and short-term retrospective analysis (one week into the past), how accurately does the system monitor and warn? In order to conduct these tests, the EWAMS data collection operation at IPPRC is now "real-time." *New York Times* or NYT data are one day behind on any given date; *Manchester Guardian* or MAG data show a lag of five to seven days. The purpose of this section is to compare in a systematic fashion the retrospective performance of NYT and MAG in terms of EWAMS monitoring and warning of international crises.

5.3.1 Hotspots lists. The rank order correlation statistic rho is used to evaluate the conflict actor rankings generated by MAG and NYT during each month of 1979. Rho

varies from a perfect negative correlation (-1.00) to a perfect positive one (+1.00). If the two rankings are identical, rho = +1.00; if the rankings are reversed, rho = -1.00. The formula for computing rho is:

$$r_{rank} = 1 - \frac{6 \Sigma D^2}{N (N^2-1)}$$

where D = differences for the two ranks; and

N = number of total items ranks.

The example in Table 5-7 illustrates the procedure.

The rhos are presented in Table 5-8 for each of the 12 months in 1979, for the entire year, for the first 6 months of 1979, and for the second 6 months of the year. The following rationale was employed to assess the rhos.

First of all, the least desirable pattern would be one in which the correlation was highly negative, indicating the existence of an inverse relationship. If, in other words, NYT ranks an actor high, MAG tends to rank it low (or not at all). A rho of +1.00, in contrast, would imply that MAG is redundant and therefore superfluous. The third type of result is when the rhos are fairly strong but not perfect correlations; rhos above .50 but below .80 or .90 are "preferred." This range indicates that the two sources are not completely discrepant but, simultaneously, some advantage does accrue by tracking both sources.

Table 5-7

THE CALCULATION OF RHO: AN ILLUSTRATION

	NYT RANK	MAG RANK	DIFFERENCE (D)	ΣD^2
U.S.A.	1	1	—	—
IRAN	2	2	—	—
U.S.S.R.	3	3	—	—
U.K.	4	4	—	—
U.N.	5	12.5	7.5	56.25
ZIMBABWE	6	5	1	1
NATO	7	12.5	5.5	30.25
LIBYA	8	12.5	4.5	12.25
PLO	9	12.5	3.5	12.25
ISRAEL	10	8	2	4
SOUTH AFRICA	12.5	6	6.5	42.25
RHODESIA	12.5	7	5.5	30.25
VIETNAM	12.5	9	3.5	12.25
EGYPT	12.5	10	2.5	6.25

$\Sigma D^2 = 215$

$N = 14$

$$\text{rho} = 1 - \frac{6 \times 215}{14(14^2 - 1)} = 1 - \frac{1290}{2730} = 1 - .47 = .53$$

Table 5-8

NYT VS. MAG: RANK ORDER CORRELATIONS
FOR CONFLICT HOTSPOTS LIST

Time Frame	RHO
01/79	.61
02/79	.65
03/79	.57
04/79	.36
05/79	.52
06/79	.47
07/79	.43
08/79	.52
09/79	.55
10/79	.23
11/79	.66
12/79	.53
01/79-06/79	.82
07/79-12/79	.74
01/79-12/79	.79

Generally, the rankings conform to the third pattern. The overall (12-month) rho is .79 and the rhos for the first and second six month periods are .82 and .74, respectively. At this high level of aggregation, the two source lists tend to be similar in nature.

NYT and MAG converge in identifying the U.S. as the most conflictual actor for all 12 months and for the two half-year periods. Generally, the actors within the top five are the same, although sometimes there are slight differences within the top five lists (e.g., Israel is #2 on the NYT list and #3 on the MAG list for the first half of 1979). The top five rankings are identical in 7 of 15 instances and vary within the top five in 7 of 15 cases; in only one case, then, is an

actor in the top five list from one source but not the other. This is the PLO, which is ranked fifth on the NYT list for the second half of 1979 but ranked ninth by MAG.

The rankings from sixth to tenth display similar patterns, with the bulk of the rankings being identical or close. The only consistent tendency is MAG's relative emphasis on Great Britain, which makes only the MAG list twice (January-June, 1979 and January-December, 1979) and is ranked sixth by NYT and third by MAG during the July-December time span. The monthly results show more variation, with the rhos ranging from .23 (October) to .66 (November). Eight of the 12 monthly rhos are above the arbitrary .50 cutoff and all are below the (equally arbitrary) .80 ceiling, suggesting that inter-source similarity is discernible but not overwhelming.

During the early part of 1979, the China-Vietnam crisis was a dominant issue on the agenda of international affairs; this was clearly reflected in both the MAG and NYT lists. Especially in February, when both ranked China first and Vietnam third, the Sino-Vietnamese crisis was captured by the two elite public media sources. This crisis and its protracted aftermath remained "hot" through the month of July.

Both sources also tended to identify the tense Uganda-Tanzania relationship--an ongoing conflict arena which had flared up in the fall of 1978 and culminated with the ouster

of Idi Amin. After April, the Uganda-Tanzania conflagration subsided.

The third salient hotspot pair during 1979 was Israel and Egypt. The Camp David breakthrough of late 1978 led to an intense period of bargaining in the ensuing months. In addition to the superpowers, Rhodesia~~, Zimbabwe, and the PLO also fre-~~ quently appeared on the lists. Toward the latter part of the year, Iran surfaced; it was ranked third on both lists for the month of August.*

According to the rhos, the most discrepant months were April and October. During the former month, the U.S., Israel, and Egypt were ranked in the top three by both NYT and MAG. However, four NYT countries did not appear on the MAG hotspots list: Tanzania (ranked fifth); China (seventh); Uganda (eighth); and Lebanon (ninth). Rhodesia, Pakistan, Zimbabwe, and the European Economic Community were ranked by MAG but not by NYT.

October featured only four actors which appeared on both source lists: the U.S. (ranked 1 by NYT and 2 by MAG); Zimbabwe (ranked 2 by NYT and 3 by MAG); Britain (ranked 3 by NYT and 1 by MAG); and the Soviet Union (ranked 4 by NYT and

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*Iran first showed up in March 1979, ranking sixth on the MAG list; it appeared again on the MAG list in May (with a rank of seventh) and was on the NYT list (at tenth) and the Mag list (at sixth) in June.

6 by MAG). While NYT highlighted Egypt, Israel, Rhodesia, and Iran, MAG focused on Vietnam, Thailand, France, China, the EEC, and the UN.

November was characterized by a much higher level of agreement, with the seizure of the U.S. embassy in Tehran early in the month detonating the Iran-U.S. crisis. NYT ranked Iran first and the U.S. second; MAG agreed on the identity of the actors but reversed the order. The upsurge in activity in the Rhodesia-Zimbabwe (Patriotic Front)-United Kingdom arena was reflected in both sources. The November rho of .66, the highest of the year, was approximated only by the rhos of January and February, when the Sino-Vietnamese crisis dominated world affairs.

5.3.2 Monitoring and warning country pair lists. The country pairs which comprise the monthly monitoring and (crisis) warning lists are presented in Table 5-9. The entries represent the number of indicators which crossed the thresholds for monitoring (of a total of five possible) and for warning (of a total of three possible). Since the monitoring search goes back three months from the alert date, for any given month the maximum total would be 15 thresholds; the maximum for the more stringent warning search, which involves only the immediate preceding month, is three thresholds.

Table 5-9

MONITORING AND WARNING COUNTRY PAIR LISTS:
SOURCE COMPARISON

A. 790101

		MAG		NYT	
		M	W	M	W
1.	usa-usr	3	1	1	0
2.	usa-isr	5	0	1	0
3.	usa-rho	1	0	2	0
4.	usa-uar	3	0	0	0
5.	unk-rho	2	0	1	0
6.	unk-uga	1	0	0	0
7.	usr-chn	2	0	2	0
8.	isr-uar	3	0	1	0
9.	uga-taz	4	1	0	0
10.	usa-chn	0	0	1	0
11.	isr-usr	0	0	1	0
12.	isr-syr	0	0	1	0
13.	uar-usr	0	0	1	0
14.	uar-syr	0	0	1	0
15.	usr-mlg	0	0	1	0
16.	usr-vtn	0	0	2	0
17.	chn-unk	0	0	2	0
18.	chn-vtn	0	0	4	0

Legend:

MAG = Manchester Guardian;

NYT = New York Times;

M = Monitoring Threshold (s) Exceeded;

W = Warning Threshold (s) Exceeded.

B. 790201

		MAG		NYT	
		M	W	M	W
1.	usa-unk	1	0	0	0
2.	usa-usr	3	0	0	0
3.	usa-isr	4	0	1	0
4.	usa-uar	3	0	0	0
5.	usa-gmw	2	0	0	0
6.	usa-frn	2	0	0	0
7.	unk-usr	2	0	0	0
8.	unk-uga	1	0	0	0
9.	usr-chn	2	0	2	1
10.	isr-uar	2	0	0	0
11.	uga-taz	4	1	0	0
12.	usa-chn	0	0	2	0
13.	usa-cht	0	0	5	0
14.	usa-uno	0	0	1	0
15.	usa-cam	0	0	4	0
16.	isr-vtn	0	0	1	0
17.	isr-uno	0	0	2	0
18.	isr-plo	0	0	3	1
19.	chn-vtn	0	0	5	1
20.	chn-cht	0	0	6	0
21.	chn-cam	0	0	1	0
22.	usr-vtn	0	0	2	0
23.	usr-cam	0	0	3	0
24.	vtn-uno	0	0	1	0
25.	vtn-cam	0	0	5	1
26.	uno-cam	0	0	2	0

Table 5-9

MONITORING AND WARNING COUNTRY PAIR LISTS:
SOURCE COMPARISON (Cont'd.)

C.	790301	MAG		NYT	
		M	W	M	W
1.	usa-usr	3	0	2	0
2.	usa-chn	3	0	4	0
3.	usa-unk	1	0	0	0
4.	usa-isr	5	1	1	0
5.	usa-uar	4	0	1	0
6.	usa-gmw	2	0	0	0
7.	usa-frn	2	0	0	0
8.	usr-chn	4	1	2	1
9.	usr-unk	2	0	0	0
10.	chn-vtn	6	1	8	1
11.	unk-uar	1	0	0	0
12.	unk-vtn	1	0	0	0
13.	unk-rho	1	0	0	0
14.	isr-uar	2	0	0	0
15.	usa-uno	0	0	1	0
16.	usa-cht	0	0	4	0
17.	usa-irn	0	0	5	0
18.	chn-cht	0	0	6	0
19.	isr-vtn	0	0	1	0
20.	isr-uno	0	0	2	1
21.	isr-irn	0	0	3	0
22.	usr-irn	0	0	1	0
23.	vtn-unp	0	0	2	0
24.	vtn-irn	0	0	2	0
25.	uar-irn	0	0	2	0
26.	uno-irn	0	0	2	0

D.	790401	MAG		NYT	
		M	W	M	W
1.	usa-usr	1	0	2	0
2.	usa-chn	3	0	4	0
3.	usa-isr	4	0	2	0
4.	usa-unk	1	0	0	0
5.	usa-uar	3	0	2	0
6.	usa-irn	4	0	5	0
7.	usa-plo	5	0	0	0
8.	usr-chn	3	1	3	1
9.	usr-unk	2	0	0	0
10.	usr-uar	1	0	0	0
11.	usr-irn	1	1	1	0
12.	chn-vtn	6	2	8	0
13.	isr-uar	2	0	1	0
14.	isr-irn	1	0	4	0
15.	isr-plo	3	0	3	0
16.	unk-uar	1	0	0	0
17.	unk-vtn	1	0	0	0
18.	uar-irn	1	0	4	0
19.	chn-uno	0	0	1	0
20.	usr-vtn	0	0	1	0
21.	isr-vtn	0	0	1	0
22.	isr-uno	0	0	2	0
23.	vtn-uno	0	0	3	0
24.	vtn-irn	0	0	2	0
25.	uar-plo	0	0	1	0
26.	uar-mlg	0	0	1	0
27.	uno-irn	0	0	2	0
28.	irn-plo	0	0	3	0
29.	irn-mlg	0	0	4	0

Table 5-9

MONITORING AND WARNING COUNTRY PAIR LISTS: SOURCE COMPARISON (Cont'd.)

E.	790501	MAG		NYT	
		M	W	M	W
1.	usa-usr	2	0	3	0
2.	usa-isr	4	0	2	0
3.	usa-uar	3	0	2	0
4.	usa-chn	3	0	1	0
5.	usa-irn	4	0	4	0
6.	usa-plo	5	0	1	0
7.	usr-uar	1	0	0	0
8.	usr-chn	4	0	3	1
9.	usr-irn	1	0	1	0
10.	isr-uar	3	0	1	0
11.	isr-irn	1	0	4	0
12.	isr-plo	3	1	4	0
13.	uar-unk	1	0	0	0
14.	uar-irn	2	0	2	0
15.	chn-vtn	6	0	9	0
16.	vtn-unk	1	0	0	0
17.	isr-uno	0	0	1	0
18.	chn-uno	0	0	3	0
19.	vtn-uno	0	0	2	0
20.	uar-plo	0	0	1	0
21.	uar-mlg	0	0	2	0
22.	uno-irn	0	0	2	0
23.	plo-irn	0	0	3	0
24.	irn-mlg	0	0	5	0

F.	790601	MAG		NYT	
		M	W	M	W
1.	usa-isr	2	0	1	0
2.	usa-uar	1	0	1	0
3.	usa-usr	1	0	1	0
4.	usa-chn	1	0	0	0
5.	usa-plo	5	0	1	0
6.	usa-irn	4	1	0	0
7.	isr-uar	4	0	2	0
8.	isr-chn	1	0	0	0
9.	isr-unk	1	0	0	0
10.	isr-plo	4	1	5	1
11.	isr-uno	2	0	0	0
12.	uar-usr	1	0	0	0
13.	uar-plo	2	0	1	0
14.	uar-irn	2	0	0	0
15.	usr-chn	3	0	2	0
16.	usr-irn	1	0	0	0
17.	chn-vtn	6	0	6	0
18.	unk-uno	1	0	0	0
19.	usa-uno	0	0	1	0
20.	isr-leb	0	0	3	0
21.	uar-mlg	0	0	3	0
22.	chn-uno	0	0	3	0
23.	uno-vtn	0	0	1	0
24.	uno-mlg	0	0	1	0
25.	uno-leb	0	0	3	0
26.	plo-leb	0	0	1	0

Table 5-9

MONITORING AND WARNING COUNTRY PAIR LISTS:
SOURCE COMPARISON (Cont'd.)

G.	790701	MAG		NYT	
		M	W	M	W
1.	usa-usr	2	0	3	0
2.	usa-chn	1	0	0	0
3.	usa-vtn	1	0	0	0
4.	isr-unk	1	0	0	0
5.	isr-uar	4	0	1	0
6.	isr-usr	1	0	0	0
7.	isr-chn	1	0	0	0
8.	isr-plo	3	1	4	1
9.	isr-uno	2	0	1	0
10.	unk-usr	1	0	0	0
11.	unk-vtn	3	0	0	0
12.	unk-frn	1	0	0	0
13.	unk-uno	1	0	0	0
14.	uar-usr	1	0	0	0
15.	uar-chn	1	0	2	0
16.	uar-plo	3	0	0	0
17.	uar-uno	1	0	0	0
18.	usr-chn	2	0	1	0
19.	usr-uno	1	0	0	0
20.	chn-vtn	3	0	4	0
21.	chn-uno	1	0	2	0
22.	frn-uno	2	0	0	0
23.	usa-isr	0	0	2	0
24.	usa-plo	0	0	1	0
25.	isr-vtn	0	0	1	0
26.	isr-leb	0	0	4	0
27.	uar-mlg	0	0	2	0
28.	uno-mlg	0	0	1	0
29.	uno-leb	0	0	4	0
30.	plo-leb	0	0	1	0
31.	mlg-vtn	0	0	1	0

H.	790801	MAG		NYT	
		M	W	M	W
1.	usa-isr	1	0	1	0
2.	usa-uar	1	0	1	0
3.	usa-usr	1	0	2	0
4.	usa-chn	1	0	0	0
5.	usa-vtn	2	0	0	0
6.	usa-jap	1	0	0	0
7.	unk-isr	1	0	0	0
8.	unk-usr	1	0	0	0
9.	unk-vtn	3	0	0	0
10.	unk-frn	1	0	0	0
11.	unk-jap	2	0	0	0
12.	unk-rho	2	0	0	0
13.	isr-uar	3	0	1	0
14.	isr-usr	1	0	0	0
15.	isr-chn	1	0	0	0
16.	uar-usr	1	0	0	0
17.	uar-chn	1	0	2	0
18.	uar-frn	1	0	0	0
19.	usr-chn	3	0	1	0
20.	chn-vtn	3	0	3	1
21.	frn-jap	1	0	0	0
22.	usa-mlg	0	0	1	0
23.	usa-nic	0	0	7	0
24.	isr-uno	0	0	2	0
25.	isr-plo	0	0	3	1
26.	isr-vtn	0	0	1	0
27.	uar-mlg	0	0	1	0
28.	uar-plo	0	0	1	0
29.	uno-mlg	0	0	1	0
30.	vtn-mlg	0	0	3	0
31.	mlg-nic	0	0	1	0

Table 5-9

MONITORING AND WARNING COUNTRY PAIR LISTS:
SOURCE COMPARISON (Cont'd.)

I.	790901	MAG		NYT	
		M	W	M	W
1.	usa-unk	3	1	0	0
2.	usa-isr	2	0	2	0
3.	usa-usr	2	0	3	0
4.	usa-uar	1	0	1	0
5.	usa-mal	1	0	0	0
6.	usa-sin	1	0	0	0
7.	usa-taz	1	0	0	0
8.	unk-usr	1	0	0	0
9.	unk-rho	2	0	0	0
10.	unk-mal	2	0	0	0
11.	unk-sin	1	0	0	0
12.	unk-taz	3	0	0	0
13.	unk-frn	1	0	0	0
14.	isr-usr	1	0	0	0
15.	isr-uar	1	0	0	0
16.	usr-uar	1	0	0	0
17.	uar-frn	1	0	0	0
18.	mal-sin	1	0	0	0
19.	usa-irn	0	0	3	0
20.	usa-vtn	0	0	2	0
21.	usa-mlg	0	0	2	0
22.	usa-chn	0	0	1	0
23.	isr-vtn	0	0	1	0
24.	isr-mlg	0	0	1	0
25.	isr-plo	0	0	3	1
26.	isr-uno	0	0	2	0
27.	usr-irn	0	0	1	0
28.	usr-chn	0	0	1	0
29.	irn-mlg	0	0	3	0
30.	vtn-mlg	0	0	3	0
31.	vtn-chn	0	0	3	0
32.	plo-uar	0	0	1	0
33.	chn-uar	0	0	2	0

J.	791001	MAG		NYT	
		M	W	M	W
1.	usa-isr	2	0	3	0
2.	usa-unk	3	0	0	0
3.	usa-usr	2	0	3	0
4.	usa-uar	1	0	1	0
5.	usa-irn	1	0	3	0
6.	usa-taz	2	0	0	0
7.	usa-zim	1	0	0	0
8.	usa-vtn	2	0	0	0
9.	unk-rho	3	0	0	0
10.	unk-taz	3	0	0	0
11.	unk-zim	3	0	0	0
12.	unk-vtn	2	0	0	0
13.	rho-zim	4	1	0	0
14.	usr-irn	1	0	0	0
15.	usa-chn	0	0	1	0
16.	usa-mlg	0	0	2	0
17.	usa-vtn	0	0	2	0
18.	isr-plo	0	0	3	0
19.	isr-mlg	0	0	1	0
20.	irn-usr	0	0	1	0
21.	irn-mlg	0	0	3	0
22.	usr-chn	0	0	1	0
23.	plo-uar	0	0	1	0
24.	chn-vtn	0	0	3	0
25.	mlg-vtn	0	0	2	0
26.	mlg-rho	0	0	3	0

Table 5-9

MONITORING AND WARNING COUNTRY PAIR LISTS:
SOURCE COMPARISON (Cont'd.)

K.	791101	MAG		NYT	
		M	W	M	W
1.	usa-unk	3	0	0	0
2.	usa-isr	1	0	2	0
3.	usa-usr	3	0	3	0
4.	usa-irn	1	0	2	0
5.	usa-vtn	1	0	0	0
6.	unk-rho	2	0	2	0
7.	unk-zim	8	1	5	1
8.	unk-vtn	2	0	0	0
9.	unk-frn	2	0	0	0
10.	usr-irn	1	0	0	0
11.	rho-zim	4	0	4	1
12.	vtn-frn	1	0	0	0
13.	usa-chn	0	0	1	0
14.	usa-mlg	0	0	1	0
15.	isr-uar	0	0	1	0
16.	isr-mlg	0	0	1	0
17.	irn-mlg	0	0	4	0
18.	chn-mlg	0	0	1	0
19.	mlg-rho	0	0	3	0

L.	791201	MAG		NYT	
		M	W	M	W
1.	usa-irn	5	3	6	3
2.	usa-usr	3	0	4	1
3.	usa-vtn	1	0	0	0
4.	unk-irn	3	0	3	2
5.	unk-zim	10	0	5	0
6.	unk-rho	2	0	3	0
7.	unk-vtn	1	0	0	0
8.	unk-frn	2	0	0	0
9.	irn-usr	2	0	1	0
10.	irn-frn	2	0	0	0
11.	zim-rho	4	0	4	0
12.	usr-chn	1	0	0	0
13.	chn-vtn	2	1	0	0
14.	chn-frn	1	0	0	0
15.	usa-isr	0	0	1	0
16.	irn-uar	0	0	1	0
17.	irn-plo	0	0	3	1
18.	irn-chn	0	0	1	0
19.	isr-uar	0	0	1	0
20.	isr-plo	0	0	2	1

Several general comments should be made about the findings displayed in Table 5-9. First, the EWAMS default criteria were in effect for each monthly run. This means that conflict hotspots lists were generated for each alert date; based on the top ten conflict actors, the system examined every possible combination of country pairs for both the monitoring and warning lists. It is possible that two countries could have been in a serious crisis situation but would not have appeared on the list because either or both failed to make the initial input (hotspots) list.*

Secondly, the nature of the monitoring lists is somewhat different from the warning list. While the latter is a crisis projection list, the monitoring pairs represent a "watch advice" signal. Included are tense situations and potential crises; also registered on many lists are situations of unusual cooperation between formal or potential allies, generally in response to a perceived threat from a third party.

It should be noted in this context that the monitoring thresholds include total activity probability (of .5 or higher), cooperation probability (of .5 or higher), and Hrel or uncertainly (.5 or higher). For example, Israel and the UAR appeared on the MAG January 1979 list, with three of the

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*The user may add or delete actors to or from the initial list.

monitoring thresholds exceeded. The preceding month, of course, featured the Camp David breakthrough. All three indicators were Hrel, which varies from 0 to 1.0, with higher scores indicating greater uncertainty or higher complexity; the Israel-UAR Hrels were .55 (October 1978), .58 (November 1978), and .62 (December 1978).

Another illustrative example is the February 1979 MAG monitoring list. Both the U.S.-France and the U.S.-West Germany pairs appeared; for the former, the total probability was .63 and the cooperation probability was .87 (both in January 1979) while for the latter, the total probability was .50 and the cooperation probability was .76 (also both in January 1979).

Aside from the obvious caveat that alert list pairs, thresholds, and indicators should be analyzed in context rather than mechanically or arbitrarily, these results suggest that EWAMS may be of some value as a mechanism for tracking alliance phenomena.* Although the system has been designed as a crisis and conflict monitoring and warning system, in some cases the probabilities and indicators may reveal significant patterns pertaining to cooperative phenomena. In certain contexts, for example, Hrel may be indicative of a cooperative breakthrough; periods of impending

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*For an application to the Middle East, see Daly and Andriole (1979).

detente are probably as complex as relations which are escalating to a crisis.

A recent case provides a very graphic illustration. After a history of tension and conflict, Rhodesia and Zimbabwe (the Patriotic Front) achieved a cooperative breakthrough and elections were held in early 1980. In September of 1979, the cooperation probability was .95 while the conflict and total probabilities were only .24 and .40, respectively. In January and February of 1980, cooperation again experienced a probabilistic upsurge--to .92 and .81, respectively. Meanwhile, the January and February total probabilities were .77 and .54; the comparable conflict probabilities were .55 and .44.

As Table 5-9 suggests, 1979 was an unusually crisis-plagued year.* Including the three superpower dyads (because of their intrinsic importance to world affairs and also because of the tense Sino-Soviet relationship and the deteriorating U.S.-Soviet relationship), both the MAG and NYT data as well as intuitive judgment suggest that there were 13 distinct crisis or potential crisis arenas.** These include:

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*The EWAMS probabilities, for example, are based on 48 crisis dyads from 1966-1978, suggesting an average of 3 or 4 crisis country pairs (rather than crises per se) a year.

**This includes the U.S.-Israel-UAR arena.

- China-Vietnam
- Israel and the PLO
- Zimbabwe

  -U.K.-Zimbabwe

  -U.K.-Rhodesia

  -Rhodesia-Zimbabwe
- U.S.-Iran
- Iran-others
- U.S.-U.S.S.R.
- U.S.S.R.-China
- U.S.-China
- U.S.-China/Taiwan
- China-China/Taiwan
- U.S.-Nicaragua
- Camp David and its aftermath

  -U.S.-Israel

  -U.S.-Egypt

  -Egypt-Israel
- U.S.-U.K.

The last pair warrants a comment. The U.S. and Britain are listed only because of a small number of events in August of 1979. For the alert date 790901 for the MAG source, there were three monitoring thresholds crossed (tension = 56; Hrel = .5; conflict probability = .87) and one warning threshold crossed (conflict probability = .87).

The dispute revolved around Northern Ireland. Early in August, the British Foreign Office expressed increasing apprehension about the growing influence of the Irish American lobby in the U.S., specifically with reference to an alleged extra arms sale to the Royal Ulster Constabulary. The U.S. State Department denied that there had been a policy change. Things heated up when New York Governor Hugh Carey invited British and Irish representatives to attend talks in the U.S. on the future of Northern Ireland, an overture which the British government rejected.

A comparison of MAG and NYT with respect to the monthly lists reveals several arenas commonly identified as well as some which one or the other source tended to focus on. In addition, there were numerous idiosyncratic deviations, with both sources selecting out particular pairs not identified by the other.

Consensus was highest on the very salient crisis pairs of 1979: the U.S.-Iran; China-Vietnam; U.K.-Rhodesia-Zimbabwe; Israel-PLO. The two sources were very similar in their readings of the U.S.-Iran situation in April, May, and December. MAG crossed four monitoring thresholds in April and May while NYT exceeded five thresholds in April and four in May. In December, MAG generated five monitoring threshold readings and three for warning; NYT featured six monitoring and three warning readings.

However, NYT tended to identify the Iranian-U.S. arena as conflictual when MAG was silent. On three occasions--May, September, and October--NYT recorded three or more monitoring readings, whereas MAG had one in October and none in the other two months. In contrast, MAG featured four monitoring readings and one for warning in January of 1979; NYT was silent.

NYT also was more prone to illuminate tense or unusual relations between Iran and other countries. Several examples are displayed below. They all show the higher (and not surprising) level of attention on the part of the U.S. prestige newspaper. However, both sources did pick up the U.K.-Iran pair in December.

Alert Date	Monitoring		Warning	
	MAG	NYT	MAG	NYT
790401	3	3	0	0
790501	3	4	1	0
790601	4	5	1	1
790701	3	4	1	1

In addition to the actual crisis of 1979, the superpowers were tracked--and in generally congruent ways--by both MAG and NYT. From May through the end of the year, both sources reported several monitoring threshold crossings for the U.S.-Soviet pair. The Sino-Soviet tension of the first half of 1979 registered in both sources; from January to May,

both reported several monitoring threshold crossings a month. In addition, NYT featured one crisis warning for 790201; both recorded one such warning for 790301 and again for 790401; NYT alone yielded one crisis warning for 790501.

Several very serious situations from the U.S. perspective were captured by NYT but not by MAG. Especially salient in this category were the U.S.-Taiwan and Taiwan-China pairs in February and March, after the U.S. recognition of Peking. In all four cases, NYT reported four, five, or six monitoring readings while MAG contained none at all. The other case reflected only in NYT was the U.S.-Nicaragua pair during August of 1979, with seven monitoring readings in NYT and none in MAG.

Overall, MAG tended to reflect more of the U.S.-Israeli-Egyptian dynamics. In January, for example, it reported five watch advice readings (compared to one in NYT) for U.S.-Israel; in February, MAG generated four such readings (again, compared to one in NYT).

One other idiosyncratic feature of the MAG profile should be mentioned; not surprisingly, the British source yielded readings for the U.K. much more frequently than did NYT. Of 41 occasions, Britain was on both lists only six times and was on NYT and not MAG only once.

Crude summary statistics reveal the overall patterns for MAG vis-a-vis NYT. Of 309 discrete readings (i.e., all country pairs which crossed at least one monitoring threshold during one of the month time frames), 227 were situations in which MAG was 0 and NYT was 1 or more (or vice versa). There were 58 readings for which <u>both</u> reported at least one threshold crossed but the frequencies differed (e.g., NYT with 2 thresholds surpassed and MAG with 1); 20 of the 309 involved comparisons for which the difference across sources was four or more.* Finally, 23 pairs were identical in terms of number of indicators (assuming a minimum of one).**

The warning readings logically fall into four types: both sources zero; MAG and NYT both above zero but with unequal numbers of thresholds exceeded; MAG and NYT both above zero and equal in magnitude; one source is zero and the other is one or more. Of 309 readings, 276 were cases which conformed to the first criterion (i.e., neither source yielded one or more crisis warnings). There were no cases when both broke the threshold but with different numbers of indicators. On seven occasions, both surpassed

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*This includes pairs for which one source was 0 and the other 4 or more.

**This of course does not mean that the indicator values--or even the indicators per se--were identical; the comparison here assumes that what is crucial is the crossing of a threshold. Identical scores of 3, for example, could involve different indicators, values, and even months.

the threshold(s) with equal number(s) of indicators. Finally, 26 times one source reported at least one warning whereas the other reported none.

These findings are not troublesome in the sense that crises are very rare and crisis warnings should therefore be rare. Although indicator readings were equivalent in frequency only seven times and source A reported one or warnings and source B reported none 26 times, these results are neither inexplicable nor disturbing per se. Most of the latter involved instances when source A reported that one threshold had been exceeded and source B failed to note any crossings; this accounts for 23 of the 26 cases.* These can safely be regarded as "false alarms" in the overwhelming majority of instances.

5.4 Conclusions

The results presented in this section should be regarded as tentative in nature. Work is currently being conducted by IPPRC on FBIS (Foreign Broadcast Information Service) data and by Mathtech on classified (cable traffic) data; both

*The three exceptions included: two MAG thresholds for China-Vietnam and none for NYT (790401); two NYT thresholds for Iran-Multilateral Group and none for MAG (790901); two NYT thresholds for U.K.-Iran and none for MAG (791201). The second was concerned primarily with Iranian charges against and warnings to Western foreign news reporters.

efforts involve data collection only for sub-Saharan African international affairs. Included are key African dyads (e.g., Angola-South Africa, Ethiopia-Somalia, etc.) as well as events sent by the superpowers to relevant African countries.

The FBIS and classified data patterns will be compared systematically with those generated by MAG and NYT. Very preliminary findings suggest that the former two sources yield a significantly greater volume than either of the latter two; the classified data are especially "data-rich." Comparative source performance profiles, however, cannot be delineated until more research is conducted.

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6.0 FUTURE RESEARCH

The Early Warning and Monitoring System (EWAMS) has progressed from a prototype to a fully developed system. At the same time, modifications and enhancements are constantly being made. These include both "cosmetic" and other user-oriented refinements (e.g., help routines) as well as research-based additions. An example of the latter is threat networks, discussed in the next section.

6.1 Threat Networks

The EWAMS has traditionally been dyadic in focus. In other words, the emphasis has been on pairs of actors (country pairs, two JCS regions, a region and a country); this applies to both analytic I&W and automated I&W. The crisis warnings generated by the latter, for example, consist of country pairs. The Country Activity Profile (CAP) feature of EWAMS deals with country-level indicators (see Hopple and Snyder, 1979).

A comprehensive I&W warning and monitoring system should include indicators at several distinct levels of analysis:

- Country performance and activity measures
- Dyadic indicators

- Networks
- Systemic scans

Networks refer to clusters of countries, situations when conflict and tension "spread" and spill over. This is a common syndrome in international politics. The India-Pakistan crises and war of 1971, for example, involved not only the central protaganists; the United States, Soviet Union, and China were peripheral but clearly involved key actors as well.

Preliminary research has already been conducted on the subject of threat networks; the key proposition is that, after a threat becomes present in the relations between two antagonists, a specific subsystem will often develop.* Threat subsystems embrace the central actors and the ever-increasing web of allies and adversaries.

The Iranian and Afghan crises of late 1979 and early 1980 are ideal candidates for threat network analysis.** The Iran-U.S. embassy crisis eventually "spread," involving a number of U.S. allies and others. The Afghan crisis soon became a U.S.-Soviet affair, eliciting attention from China, Pakistan, Iran, and various Western European and Middle

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*See Rothe (1980b) for details.

**Details on these cases are provided in Rothe (1980a).

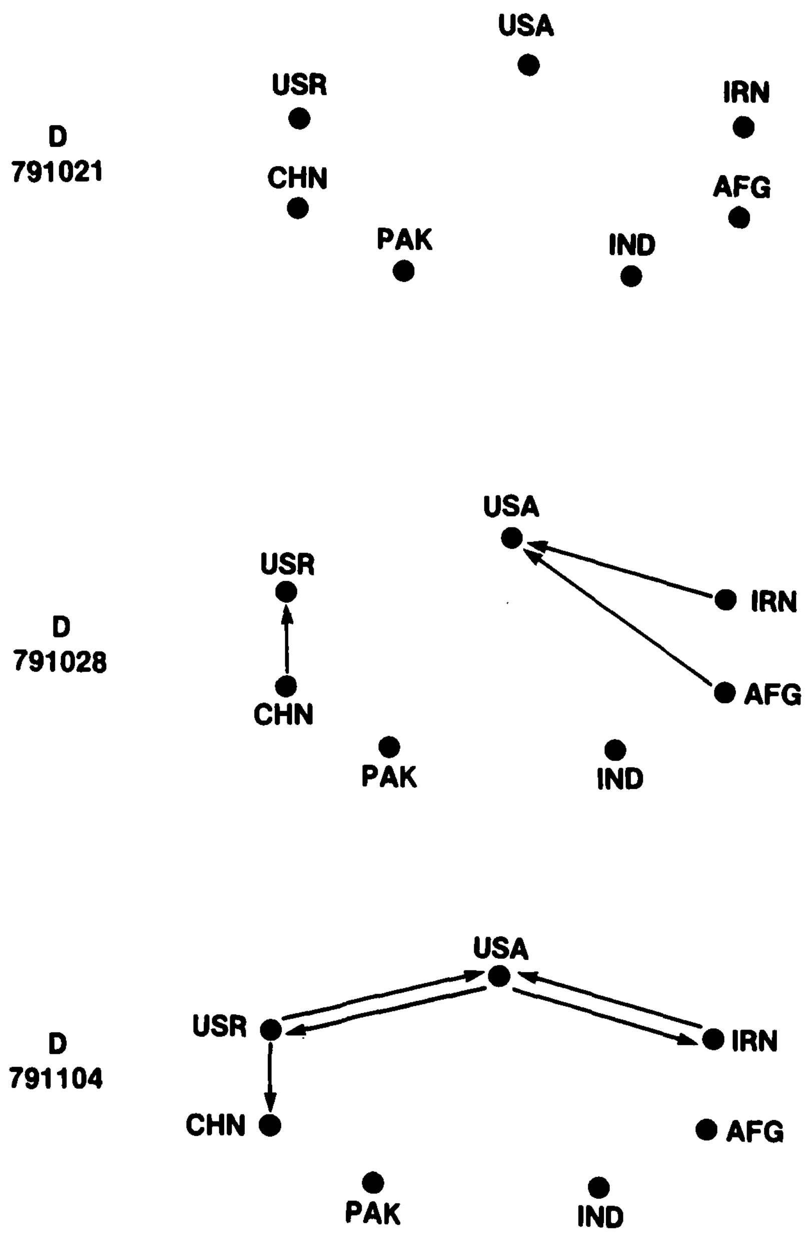
Eastern countries. It could be argued that the Iranian and Afghan crises became "fused threat networks," with nations reacting to the "arc of crisis" in the Middle East and South Asia.

For illustrative purposes, seven actors (the United States, Soviet Union, Iran, Afghanistan, Pakistan, China, and India) can be examined for the weeks of 791021, 791028, and 791104 (Figure 6-1). These weeks are displayed here in three directed graphs or digraphs. Each digraph is labelled by a D (digraph) and the beginning date of the week.

Most striking is that the first digraph (D 791021) has absolutely no relations. Although each of these nations may be interacting with a variety of other nations, none of them is interacting with each other. No threat network exists at this particular point in time. In the second digraph (D 791028), actions take place within three country pairs (CHN ⟶ USR, AFG ⟶ USA, IRN ⟶ USA), but the actions are in one direction. While this appears to be the beginning of a threat network, the relations among the dyads are not reciprocal. The subsystem finally appears in the last digraph (D 791104). During this time period, the Iranian students seized the American embassy and tense relations between the two nations began.

Figure 6-1

ILLUSTRATIVE THREAT NETWORKS



The threat network analysis is pursued through the week ending on January 27, 1980 (800127) in Rothe's (1980a) detailed study, which develops and tests some quantitative indicators for threat network analysis and compares the 1979-1980 network results with the findings for the 1971 India-Pakistan network. Research is continuing in this area; we expect some more definitive results by early 1981.

6.2 Other Research

Daily and weekly data (raw scores and deviation scores or Z-scores) have been available to the EWAMS user for some time. Our current emphasis is on generating conflict probabilities for daily and weekly data.

The current monthly probabilities provide the foundation for this aspect of our research program. We are thus employing the discriminant function analysis methodology. However, problems unique to daily and weekly data (e.g., the frequent absence of data) have ~~dictated certain~~ methodological enhancements.

Given the focus and tasks of the I&W analyst, the concern is clearly with the short-term future--the next several days or weeks. A 30-60 day time horizon is generally the maximum interest of the typical prospective user of EWAMS. Therefore,

the ability to generate daily and weekly probabilities remains paramount on our research agenda.

Missing from the extant EWAMS indicator base is the global level. A systemic scan indicator would permit the analyst to search for crisis probabilities from the vantage points offered by distinct levels of analysis. A systemic scan indicator would monitor all global political activities, thus providing a summary measure for the current state of affairs for the world.

The rationale for systemic (and other levels) of indicators flows from the nature and structuring of the typical I&W analyst's tasks. Typically, responsibility is diffused on the basis of country and area foci; this division of labor is characteristic of DIA, CIA, State, and other elements of the national security community concerned with monitoring, forecasting, and I&W. While this organizational framework makes sense, given the voluminous amount of available information and the need to become immersed in the context and background of a country, country pair, and/or regional arena, it also poses the danger of myopia and actor- or region-specific biases. A common syndrome, for example, is for an analyst to "assume" the comparative visibility and "permanent" crisis-like nature of his or her region. Systemic (and comparative regional) indicators could provide a mechanism for correcting or at least minimizing such biases.

The envisioned indicator "staircase" would feature country-level (e.g., CAP and/or variations of it), country pair or dyadic, regional, and systemic levels. Ordinarily, an analyst could "descend" from the systemic. Is the "world" unusually active or tense? If so, from where is the trouble emanating? Comparatively, how tension-saturated are regions A and B or dyads A and B within a region?

Encouraging preliminary analysis has already been completed (see Rothe, 1979). Two currently available systemic scan possibilities were systematically compared and evaluated: the Event Flow Indicator (EFI) and the Pattern Recognition Algorithm (PRA). Among the conclusions were:

- Both systemic indicators (EFI and PRA) monitor well
- PRA is more rigorous than EFI
- PRA is easier to interpret and therefore more user-oriented
- PRA is capable of being used with extant forecasting methods
- PRA is slightly better for warning because of its sequence capacity

An advantage of the PRA scan is that it is adaptive. Each new week of data that is classified is added to the past weeks in the classification scheme. The statistical parameters of each class are always changing as a result of the addition of new patterns. If there is a gradual change in

the structure of world politics, this will be reflected in the changing parameters of each class in the typology. If there is a sudden change in the ordering of international classes generating new patterns of data which are not similar to any of the original class, a new class can be added to the typology.

It is in this sense that the PRA scan is adaptive to changes in the dynamics of the international system; each week, the new patterns that are added to the classification scheme slightly change the parameters of the patterns. Similarly, when a new pattern of data is classified, it is going to change the matrix of transition probabilities. Thus, the probabilities projecting where the system will go next also adapt and hopefully reflect the change characteristics of new orderings in the international system.

During FY 81, the utility of developing and incorporating into EWAMS a systemic scan indicator will be explored. Retrospective and real-time tests will be conducted to determine the feasibility and desirability of integrating such an indicator.

Testing of the early warning indicators with real-time and daily data remains one of our highest priorities. Ten years of WEIS data (1966-75) from the New York Times are now fully supplemented by daily updated data.

Since the WEIS data are available and are now integrated into the system on a daily basis, a real-time analysis of our indicators must continue. There is no substitute for tests and evaluations of indicators on a real-time basis. Consequently, the Project will continue to design and execute several experimental tests of the system indicators under real-time operating conditions. These tests will be based on preselected time periods to prevent ex post facto interpretations and evaluations. The results of these tests will be analyzed; depending on their outcome, appropriate modifications will be made to the system.

Using selected features of the automated EWAMS as well as specially developed internal software, EWAMS has been undergoing a series of real-time tests and evaluations. This process has involved extensive testing of the system as well as the inputs of expert judgments and the advice of current and past intelligence analysts and managers.

This process should be continued and accelerated. Testing in a real-time mode is the absolutely indispensable prerequisite for transferring a system that can reasonably be expected to be used on a day-to-day basis. Stech (1979) points out that explicit, rigorous evaluations of intelligence products and processes are rare and perilous because of bureaucratic politics and similar factors. In an off-line mode, however, there is a greater likelihood of employing the

results to enhance the performance and quality of the system. As in the past, actual rates of success and failure (hits, misses, false alarms, correct rejections) will be ascertained.

The existing framework for real-time testing and evaluations is skeletal. It involves short-term retrospective "postdictions" and short-term prospective projections; comparisons of the performance of EWAMS vis-a-vis expert judgments have also been undertaken. Clarkson et al. (1980) and other sources can be employed during FY 81 to expand and refine the evaluation framework. For example, the use of EWAMS data for monitoring and warning can be examined in a larger context (e.g., in terms of attribute and other contextual data). The use of EWAMS for constructing scenarios (employing approaches outlined in Clarkson et al., 1980) could also be pursued. These and additional enhancements and extensions will be considered and, as appropriate and feasible, implemented.

The addition of new data files, indicators, and scans as well as many other new enhancements will greatly increase the amount of information available to the user. Thus, it is critical that the system software continue to be developed as the information retrieval, monitoring, and forecasting capabilities of the system are expanded.

Every effort must be made to continue to enhance the flexibility of the system without sacrificing simplicity. Even as the system has rapidly grown over the last several months with the addition of several new analytic features and the automated module, users still only need to enter simple, brief input in order to operate the system. New enhancements to the system will continue to be dependent on feedback and suggestions from potential users. Many suggestions from potential users have already been integrated into the system. Recent enhancements which are subsumed under the rubric of user requests/suggestions include:

- Regional text
- Keyword search
- Error diagnostic checks
- Numeric input parameters
- Special purpose regions
- Textual output

In addition to maintaining system flexibility and simplicity, software developments must be compatible with the hardware and software of both potential users and other computer-based products of DARPA/CTD. This objective will require that all future developments in software and hardware be closely coordinated with other CTD projects.

SECTION II

INTRANATIONAL I&W

7.0 INTRODUCTION

Virtually no systematic, rigorous efforts have been made to develop and test procedures, approaches, and methodologies for analyzing, tracking, and projecting events and situations <u>within</u> nations. Intranational phenomena, however, are critical components of the I&W analytical process.

7.1 <u>Background</u>

Just as international politics has been the source of data bases, methodologies, and conceptual frameworks which have been transferred and adapted to international I&W contexts, students of comparative politics have probed and attempted to analyze the dynamics of violence, stress, and change within political systems. Nor is this work restricted to the domains of data collection and descriptive profiling; increasingly sophisticated causal models--which have accounted for from one-third to four-fifths of the variance--have been constructed and tested in the realm of civil strife or mass political violence. Recently, a study explicitly concerned with the forecasting of protest and rebellion has been published (Gurr and Lichbach, 1979).

The I&W analyst now has access to a data base which is large, relatively comprehensive, and sufficiently varied

substantively and temporally. Increasingly more sophisticated analytical strategies can be and have been applied. The data base-dependent developments in basic international and intranational political research (e.g., Hopple, 1978; Singer and Wallace, 1979; Wilkenfeld et al., 1978, 1979, 1980) and in the applied sphere (e.g., Andriole and Young, 1977; Bell et al., 1978; Daly, 1978) have been both prolific and impressive.

Perhaps the richest single data base in quantitative international politics is the World Event Interaction Survey or WEIS, which currently constitutes the empirical foundation for the Early Warning and Monitoring System. WEIS and other events data sets comprise only one type of data in the fields of international and comparative politics. Also pertinent are various aggregate data sets which contain political, military, economic, social, cultural, and demographic variables as well as scattered quantitatively-based content analysis, elite biographical, and interview data collections. Furthermore, most of these data sets are available to researchers through the Inter-University Consortium for Political and Social Research (ICPSR) at the University of Michigan; DARPA/CTD and other agencies and institutions have transferred data sets to ICPSR.

In the domain of international political analysis, (external) crisis research has obviously emerged as a viable subfield. The proliferation of case studies, frameworks,

propositional inventories, panels at professional meetings, special issues of journals, and other signals demonstrate the validity of this assertion (see, e.g., Hopple and Rossa, 1980). Unfortunately, comparable activity has not characterized the study of intranational crisis (or internal affairs generally).

Recent inquiry, however, has at least generated an impressive number of theoretical frameworks and empirical propositions in the amorphous realms of "internal conflict" and "aggressive participation."* Such research has obvious potential relevance to the study of indicators of intranational behavior.

7.2 Problem Statement

Recent months have witnessed the proliferation of domestic strife and tension in sub-Saharan Africa. The upheaval in Uganda in early 1979, the civil war in Chad, the recent coup in Liberia, and the continuing stress in the Union of South Africa and Namibia are among the most obvious of a constellation of intranational stresses and strains in Africa. Quite clearly, there is a need for an intranational monitoring and warning system for I&W analysts tasked with Africa.

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*See especially: Feierabend et al. (1972); Gurr (1970); Hibbs (1973); Jackman (1978); Muller (1977; 1979); Snyder (1978); and the sources cited in Hopple (1978).

The undeniable pervasiveness of intranational I&W concerns is highlighted by statistics on conflict, violence, and war. One study points out that there were 380 conflicts in the world from 1946 to 1964; 85 percent of these were internal in nature (Orlansky, 1970). Included in the 85 percent were coups, military revolutions, mutinies, civil disorders, and internal guerrilla and civil wars. This, it should be noted, excludes more moderate manifestations of societal unrest.

An intranational crisis system would focus on several interrelated, pervasive problems:

- The development, evaluation, and improvement of procedures for forecasting and monitoring a range of intranational crises
- The identification and observation of quantitative indicators for crisis warning
- The integration of quantitative indicators and methods into an interactive, user-oriented, computer-based intranational crisis early warning and monitoring system

The problem of intranational crisis warning is a complex one. Further, it has not elicited the systematic treatment which has been accorded to international crisis analysis. The responsibility for I&W analysis of such phenomena as internal stress, intranational crisis, and societal instability is diffuse; the prevailing approaches are unsystematic, ad hoc, and primarily "intuitive."

It is clear that in order to improve warning time of intranational and international crises, technology for that purpose must be continually developed and tested. Furthermore, if the technology is intended for actual use, it must be tailored to the preferences and needs of those individuals who are actual participants in the warning process. This realization permeates the proposed technical approach discussed later in this document.

7.3 Proposed Solution

An intranational monitoring and forecasting system designed for transfer to the I&W community would feature two central thrusts:

- One would focus on the nature and impact of internal stress and political change and would monitor and forecast such phenomena as:
  - coups
  - internal war
  - elite repression
  - mass instability
- The second emphasis would be the realm of potential, emerging, and actual linkages between internal stress and instability of various kinds and external and international affairs.

The existing EWAMS monitors international affairs and forecasts serious conflict and crisis episodes in the arena

of world politics. The first thrust of the proposed, new I&W system is analogous, except that the concern is intranational affairs and the anticipation and tracking of internal violence and crises.

The second driving objective of such an I&W tracking and forecasting system reflects a prominent theme of both policy analysis and basic research. *Do leaders engage in war in order to deflect attention from internal problems and failures?* More generally, is there a nexus between what goes on within a country and that actor's relations with others? The 1978-1979 Uganda-Tanzania crisis and war--coupled with the impact of the Idi Amin regime and the coup which occurred during and because of the Tanzanian incursion into Uganda--clearly illustrates the impact and dynamics of the potent and complex internal-external linkage process.

The linkage syndrome may be manifested in at least three forms. Intranational stress may lead to foreign conflict (e.g., intranational conflict spilling across the country's borders and leading to interstate conflict). Foreign conflict (war) may eventually promote intrasocietal stress (violence). In addition, intranational stress could ultimately lead to foreign intervention. It would thus be necessary to consider three distinct types of linkage models, as depicted on the following page:

Intranational Stress ➤ Foreign Conflict

Foreign Conflict (War) ➤ Intranational Stress

General Societal Weakness ➤ Intranational Disorder ➤ Being a Target of Foreign Intervention

A system relevant to African intranational I&W would consist of four primary modules:

- Data base
- Indicators
- Forecasting methodologies
- Computer base

The assembly of a data base depends initially upon the assessment and selection of sources and a survey of available and relevant types of data. The latter, of course, is integrally related to the specification of indicators.

To a considerable extent, this issue has been addressed in the past. Available cross-national intranational data have been assessed and, to an extent, assembled in earlier DARPA/CTD-supported work (Hopple, 1978); Africa-specific data and sources have been discussed and evaluated in several studies (e.g., Jackman and Boyd, 1979 and Morrison et al., 1972).

The data base should be as real-time as possible. This suggests using newspapers and/or news chronologies and FBIS to generate data on internal African affairs. Background information and such necessary data as an historical intranational crisis file can be acquired from news chronologies and/or comparative data banks.

What type of information should go into the data base? In international affairs, the EWAMS is built around a core data base called the World Event Interaction Survey (WEIS). WEIS, as noted in Section I of this report, consists of event/interactions (cooperative and conflictual acts) exchanged between and among countries as reported in several major data sources. Analogously, an intranational Africa-relevant I&W system should attempt to capture major event/interactions within countries and classify the behavior type of the discrete verbal or physical action. Whenever an event occurs and there is an identifiable actor and target, the item can be coded in an "intranational WEIS" format. For example, if a guerrilla group attacks a government post, that could be appropriately coded, with each element being assigned a numeric code in terms of:

- Time
- Actor/s
- Event type

- Target/s
- Issue type

A variety of indicators could be developed. These indicators would initially be patterned after the ones in EWAMS. For example, EWAMS includes indicators of volume (total international behavior, cooperation activity, and conflict activity) and variety (tension and complexity or uncertainty). A system of parallel intranational indicators can be conceived. These will be discussed in detail in Section 8.3.3.

A range of potential forecasting methodologies is available for the central task of an intranational I&W system, which is the estimation of the probability of an intranational crisis in country x at time t+1. Among these are:

- An array of objective forecasting techniques
  - Using sophisticated time-series modeling techniques
  - Using probabilistic forecasting methodologies
- Subjectively-based forecasting techniques
  - Using a panel of recognized external experts
  - Allowing for the input of EUCOM/J-2 analysts to revise and update probabilities

Finally, the system would have a computer base. The hardware configuration will be at DARPA/CTD's Demonstration and Development Facility (DDF), with a PDP 11/70 on-site and arrangements for the transfer of the data base, indicators, and forecasting methodologies to EUCOM/J-2 analysts with actual use via a Tektronix graphics terminal, a 4907 File Manager, and hard copy units. The software for the system would be parallel to and compatible with the extant Early Warning and Monitoring System software.

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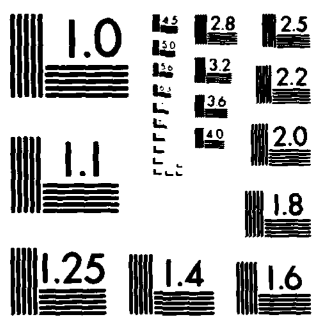


MICROCOPY RESOLUTION TEST CHART

8.0 SUMMARY OF RECENT RESEARCH

8.1 Overview

This section summarizes the indirectly relevant research on intranational I&W in Section 8.2 and reports the work completed so far on the intranational/Africa I&W prototype under development at IPPRC in Section 8.3.

Intranational political change and stress continuously affect and shape foreign policy--both directly and indirectly. However, approaches for tracking and analyzing intranational affairs in a systematic fashion are almost nonexistent. In contrast, international Indications and Warning (I&W) is a fairly well developed area. In the domains of quantitative military and--increasingly--political indicators, international I&W analysts have access to fairly large empirical data bases and reasonably productive quantitative indicator systems. Eventually, an intranational I&W analogue should be developed and implemented.

8.2 Intranational Crisis Research

8.2.1 Background. Some research has been conducted on intranational crises, although the focus has often been narrow (i.e., certain kinds of crises) and the entire range

of intranational affairs has rarely been the object of concern.

The domain of intranational crisis is not a unitary or simple phenomenon. Internal turmoil and unrest, for example, can be clustered into two broad realms: governmental instability and societal unrest (Hopple et al., 1977). The first dimension subsumes instability events which are confined to the formal political system while the second consists of behaviors which involve the mass public. This bifurcation implies that there may be a fundamental difference between intra-systemic (i.e., actions involving the political elite and perhaps a counter-elite) and extra-systemic violence and unrest (see also Hibbs, 1973: 7-8). One salient classificatory dimension for intrastate crises may therefore be the range of subnational actors involved (or the extent to which the mass public--or segments of it--is mobilized).

In addition to the range of actors and groups and such other potential criteria as the time span and the range of issues (e.g., issue-specific versus "diffuse" crises), the <u>type of issue</u> per se emerges as a key criterion. Researchers in intranational political analysis (e.g., Dahl, 1961; Lowi, 1967) and foreign policy analysis (e.g., Rosenau, 1966; Zimmerman, 1973) have exhibited some awareness of the

impact of issue area. Economic crises (e.g., recessions and depressions) and political crises (e.g., constitutional crises, the appearance of fissures within ruling coalitions, protest resignations of key cabinet members, etc.) may pose different problems and suggest varying implications. Electoral crises--such as critical elections which signal impending party realignment--should also be considered.

Other types of intrastate crises could be delineated (such as technological-environmental crises), but the primary concern here is to emphasize the importance of typing internal crises on the basis of issue content. This vital research task has been neglected in the past. If political science lacks a rich typology of situations, as George et al. (1971: xiii) note, this criticism is applicable with special force to international and intranational crisis analysis.

In fact, the degree of conceptual specification and empirical progress within prominent "cells" of the "typology" is disappointingly modest. While Morse (1972) argues convincingly that analysts should allocate more attention to the phenomenon of international economic indicators for monitoring international affairs and forecasting crises, the cross-national analysis of intrastate economic crises is both sparse and unsystematic.

Empirical research on intranational conflict (in terms of its major dimensions and especially with regard to the linkage between intranational and international conflict) is voluminous. A small sample of the major published studies includes Banks (1972), Gurr (1967, 1968a, 1968b, 1970), Gurr and Bishop (1976), and Wilkenfeld (1973).

8.2.2 Models of internal crisis and stress. The entire spectrum of determinants of intranational unrest and conflict ranges from macrosocietal structural conditions to microscopic precipitants. Considerable work is available on such remote macrolevel or structural determinants of intrasocietal unrest as economic development. A major example is the Hibbs (1973) causal analysis of a variety of potential structural sources of mass political violence. Among the predictor variables which he employed are:

- Social mobilization, government performance, and social welfare
- Sociocultural differentiation (ethnolinguistic fractionalization, group discrimination, political separatism)
- Political system characteristics (democratization, regime type, political influence of the communist and non-communist left)

Other examples include Hudson (1970), who assesses the impact of "environmental" influences (social modernization and homogeneity of political culture) and institutionalization

(differentiation and durability of political structures) as well as Jacobson (1973a), who examines the structural level forces of structural complexity, coerciveness, and system performance. Both analyses are cross-sectional (circa 1965); Hudson (1970) examines 63 countries and Jacobson (1973a) 75.

More intensive research has been conducted in the economic domain. In addition to the Hibbs (1973) study, Parvin (1973) estimates the effects of an array of economic indicators (cross-sectional data for 26 countries from different regions), while Sigelman and Simpson (1977) present findings for personal income inequality and several other economic and sociocultural aggregate indicators (also cross-sectional, for a sample of 49 nations).

A recent study by Jackman (1978) specifies and estimates a model of the structural determinants of coups d'etat for the new states of black Africa. The results, which apply to the 1960-1975 period, indicate that: social mobilization and the presence of a dominant ethnic group are both destabilizing; multipartyism per se is destabilizing; electoral turnout in the last election before independence is stabilizing. These and other findings collectively account for over four-fifths of the variance in black African coups.

Various relationships between the other two major predictor realms--intermediate micro factors (social attributes)

and immediate micro phenomena (psychological attributes)--and intrasocietal conflict have been reported. In fact, the best known theoretical frameworks in the literature, such as the work of the Feierabends and Gurr (see Feierabend and Feierabend, 1966; Feierabend et al., 1972; Gurr, 1968a, 1968b, 1970; Snyder, 1978) emphasize such psychological and social psychological concepts as frustration and relative deprivation.

The possibility that there is a nexus between internal and external conflict behavior has been supported by intuitively plausible reasoning and by sociological conflict theory. In empirical research, the relationship between intranational conflict behavior and foreign conflict behavior has been examined from a variety of methodological perspectives (e.g., Hazlewood, 1973, 1975; Rummel, 1963; Tanter, 1966; Wilkenfeld, 1973; Zinnes and Wilkenfeld, 1972). The linkage has also been measured in varying regional arenas and cross-national contexts (e.g., Burrowes and Spector, 1973; Collins, 1973; Liao, 1976; Stohl, 1975; Wilkenfeld, 1975; Wilkenfeld et al., 1972).

The early work (Rummel, 1963; Tanter, 1966) showed that there is virtually no relationship between internal and foreign conflict. On the basis of historical data, Denton (1966) concluded that there is a positive relationship.

Wilkenfeld (1968) demonstrated that the relationship is moderately strong when type of state is taken into account.

More recently, Kegley et al. (1978) reaffirmed the importance of considering the intervening variable cluster of type of nation. In a test using militarization (military expenditures as a percentage of GNP), the correlation with internal conflict (Gurr's civil strife data for 1961 to 1965) is .15 and the correlation with foreign conflict (WEIS data, 1966 to 1969) is .24. When regimes are classified by level of military expenditure, the following results emerge:

- There is a small positive relationship between domestic and foreign conflict for nations in the low militarization category.
- There is almost no relationship for countries in the medium category.
- There is an inverse relationship of considerable magnitude ($r = -.49$) for countries in the high militarization group (Middle East and the Communist nations).
- The large majority of the cases fall into the first two categories.

Some attention has also been given to the question of the linkage between war and intrasocietal political violence. Stohl (1975) uses an interrupted time series quasi-experimental design to examine the war involvement-intra-societal level changes-intrastate conflict sequences. The dependent variables are the type and extent of internal

political violence; the introduction of war leads to a search for differences between pre- and post-test slopes and intercepts. For all five major U.S. wars since the 1890s, Stohl discovers that war exerts a significant (but substantively variable) impact on patterns of internal unrest and violence.

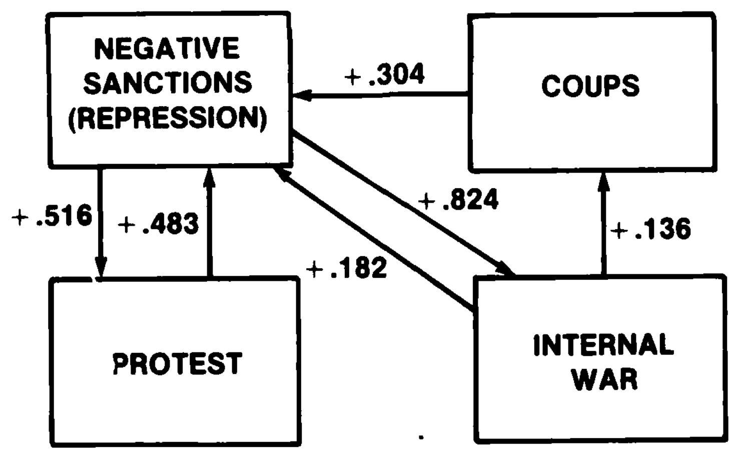
There have been various causal models constructed and tested in the cross-national study of civil strife or what Hibbs (1973) refers to as "mass political violence." The system-level studies have all relied on time series aggregate data banks, which have been amassed for all or most countries of the world for periods of a decade or more. The models have been both universal and regional in scope; both recursive and non-recursive models have been developed, a variety of variable clusters and manifest indicators have been included, and the deductive or theoretical route to model-construction has been surprisingly well represented (especially in the work of Ted Robert Gurr; see, e.g., Gurr, 1970; Gurr and Duvall, 1973; and Gurr and Lichbach, 1979).

The empirical results have been respectable and, in many instances, impressive. As noted, Jackman (1978), in a regression model which measured the impact of structural determinants on coups in Africa from 1960-1975, accounted for over four-fifths of the variance. Hibbs (1973), in two cross-sectional analyses (1948-57 and 1958-67) of 108 countries,

reported findings for a comprehensive series of single equation hypotheses and for a "block recursive" multiequation model of mass political violence. The core of the "final" Hibbs model is reproduced here as Figure 8-1. Gurr and Duvall (1973), in a study of 86 cases for the 1961-1965 period, constructed and tested an 11-variable, bloc recursive (i.e., non-recursive) simultaneous equation causal model; the R^2 for the dependent variable magnitude of political conflict (extent and intensity of conflict) was almost .75.

Figure 8-1

THE CORE OF THE FINAL HIBBS
MODEL OF MASS POLITICAL VIOLENCE



More recently, Gurr and Lichbach (1979) have presented results for a more sophisticated causal model of domestic conflict, again using the 86 nations and the 1961-1965 data. The analysis involved six separate sets of simultaneous equations (extent and intensity of protest, external dissident

support, external regime support, extent and intensity of rebellion). The R^2's ranged from .36 (intensity of protest) to .81 (intensity of rebellion), with rebellion accounted for especially well (.81, as noted, and .68 for extent or man-days of participation).

Several characteristics distinguish the Gurr and Lichbach (1979) model. First, the level and extent of theoretical specification are both encouraging--and especially as rebuttals to critics who have excoriated quantitative comparativists for "barefoot" empiricism. Conflict is viewed as a continuous process rather than as a set of discrete events; the central focus are the clusters of conditions which determine the ebbs and flows in the scope of action by anti-regime forces and the intensity of the regime's response. The theoretical system is coherently and comprehensively articulated.

Secondly, Gurr and Lichbach (1979) devote considerable attention to the problem of empirically generating composite measures of their theoretical concepts. Essentially, they pursue an elaborate four-stage process for weighting the measures in each index. The methodology, which combines z-scoring with regression analysis, is analogous to but more involved than the latent variable construction process in Partial Least Squares (PLS) causal modeling (see Wilkenfeld et al., 1979, 1980).

The third noteworthy feature is the explicit use of the model for forecasting purposes. With data primarily from 1970 for the causal variables and 1971-1975 conflict data and a quota sample of 10 cases (i.e., countries) from the larger group of 86 nations, the techniques were used to forecast properties of conflict in the 1970s. Forecasted and real data for 1971-1975 were then compared. Not surprisingly there were a number of errors; however, rebellion was predicted fairly well and the equations for intensity (deaths) showed a better fit than the ones for extent (man-days of participation).

As this review of models of intranational crisis suggests, the phenomenon is not in principle unpredictable (see, e.g., Jackman, 1978). The problem is that the research has focused on the longer-term, more slowly developing factors. More dynamic phenomena, which are more relevant from the perspective of an I&W analyst with short-term and real-time concerns, have been neglected. The proposed technical approach in Section 8.3 will address this need.

8.3 A Prototype Intranational Warning and Monitoring System

The promising and successful development of the DARPA Early Warning and Monitoring System (EWAMS) for tracking and forecasting <u>inter</u>state crises has led to increased interest in the development of a prototype system for analyzing

intranational political behavior. This interest has materialized in the form of a feasibility study now underway, an effort being pursued by several contractors who have been closely associated with EWAMS. While this feasibility study is not yet completed, it is important at this point to delineate the next logical steps in the development of an intrastate crisis warning and monitoring system.

The feasibility study addresses only a limited set of questions; these are designed to contribute to a preliminary assessment of the utility of collecting intranational events data. The questions include:

- Is the process of coding intranational events feasible--can intranational events be collected as routinely as international events?
- Is the payoff, in terms of the number and nature of intranational events for specific countries, sufficient for conducting subsequent analyses?
- What are the relative payoffs of the various event sources: newspapers; chronologies; FBIS; and cables?
- How do the EWAMS indicators (e.g., z-scores, tension, etc.) perform in an intranational context?

The Africa Warning and Monitoring System (AWAMS) was developed as a prototype during FY 80. The sequential and interrelated stages of this effort included:

- A conceptual blueprint and a set of goals

- An information base (data) design
- An indicator design
- A software design

8.3.1 The blueprint. An intranational I&W system tailored to a short-term time horizon would provide a detailed scheme for monitoring and forecasting intranational affairs. The system would have an historical base and would operate in a real-time mode. The goals of comprehensive and systematic information storage, retrieval, and display, current tracking, and anticipation of future situations and crises would all drive the development and testing of the system.

Operationally, the system would have five basic features. In summary form, these are:

- User-oriented in nature
- Parallel to the existing EWAMS in design and operation
- Systematic and comprehensive in scope and depth
  - A wide range of indicators
  - A variety of forecasting methodologies
  - Coverage of all major potential intranational crisis arenas and stress contexts
- Short-term and real-time in focus and nature
- Cumulative
  - Patterned after EWAMS

- Builds on existing data bases, models and conceptualizations in basic cross-national research (extensive work by Banks, Gurr, Jackman, and many others)

An initial evaluation of sources for Africa by IPPRC showed that several distinct types exist. Among these are:

- Prestige and other newspapers
  - Internationally known newspapers such as the New York _Times_ and the _Times_ of London
  - Africa newspapers such as the _Daily Graphic_ of Ghana
  - News wires (UPI, Reuters, etc.)
- News chronologies and almanacs
  - Such general (worldwide) sources as _Facts on File_, _Deadline Data on World Affairs_, or _Keesing's Contemporary Archives_
  - Such African sources as _Africa Diary_, _African Digest_, and _Africa Yearbook and Who's Who_
- Expert-generated data (i.e., panels of area and country experts from academia and government foreign affairs, national security, and intelligence analysts)
- Foreign Broadcast Information Service (FBIS) and/or classified sources
- Cross-national data banks
  - Arthur Banks of the State University of New York at Binghamton (domestic conflict indicators, all countries in the world, 1800s to about 1979)
  - Ted Robert Gurr of Northwestern (civil strife indicators, all countries, 1950s-1960s)
  - Robert Jackman of Michigan State (coup data for 30 African countries, 1960-1975)

- D.G. Morrison and others, Black Africa: A Comparative Handbook (a 1972 source with comparative statistical profiles in every conceivable area--ranging from ecology and demography to political instability--as well as country-specific profiles)

Indicators for monitoring and forecasting intranational affairs are virtually infinite in scope, nature, and purpose. A very partial but representative list follows:

- Volume
  - Total intranational behavior
  - Total cooperative behavior
  - Total conflictual behavior
- Variety
  - Intranational stress or tension (an intranational "thermometer")
  - Issue focus or complexity (dominance of one, a few, or many substantive issues)
- Frequency versus intensity of intranational stress
  - General stress
  - Specific forms of stress
- Change index (trends over time in intranational and international economic health, social policy, etc.)
- Polarization
  - Intra-elite
  - Competing elites
  - Elite/mass
- System performance
- Demand on the system

- Support for the system

The relevance of the discriminant methodology, which has recently been applied to EWAMS indicators with considerable success (see Section 4.0), will be ascertained. The pool of indicators must be selected and relevant thresholds must be established. Single and multiple indicator strategies will be tested. Issues relating to hit, false alarm, correct rejection, and miss rates will be central in the assessment of the forecasting component of the system.

The Africa Warning and Monitoring System (AWAMS) prototype has initially featured the tracking or monitoring dimension. The forecasting goal will be pursued after it has been established that the system successfully monitors ongoing activity.

In designing and implementing AWAMS, prior research (see, e.g., Section 8.2) and relevant approaches, designs, and frameworks have been surveyed. Integral to the prototype effort is the concept of an event/interaction. An event/interaction is a nonroutine and temporally delimited situation which features an actor (or subnational actor), a target (or subnational target), an event type, and a time frame. The event/interaction framework provides the basis for designing, developing, and testing the system.

In implementing such a framework, it is necessary to consider and explicitly take into account the salient differences between international and intranational politics. For example, the units of analysis in international politics are generally nation-states or their elites. Thus, WEIS includes only events that are public, nonroutine (which differentiates a discrete event from a transaction), and official. Even in international politics, however, other actors can be relevant; these range from subnational actors (e.g., liberation or secessionist forces) to supranational actors (e.g., universal or regional organizations).

The domestic political landscape is even more complex. Even a relatively simple model, such as the one displayed here as Figure 8-2, features four distinct types of actor groups in intranational politics. The following kinds of linkages must be considered in developing a realistic, valid coding scheme:

- Elite ◄ ► Counterelite
- Elite ◄ ► Mass
- Counterelite ◄ ► Mass
- Mass ◄ ► Mass (e.g., conflict between different tribes or religious groups, interest group interaction, etc.)

More sophisticated typologies could also be introduced (e.g., the elite, other officials, the elite public, the attentive public, apoliticals, etc.).

Figure 8-2

TYPES OF ACTORS IN AN INTRANATIONAL I&W SYSTEM

		ACTORS' ORIENTATION	
		MASS	ELITE
ATTITUDE TOWARD REGIME	PRO	PRO-REGIME MASS-ORIENTED	PRO-REGIME ELITE-ORIENTED
	ANTI	ANTI-REGIME MASS-ORIENTED	ANTI-REGIME ELITE-ORIENTED

Our initial research on the realm of African internal I&W thus reviewed the rather extensive--albeit scattered--basic research literature in this area. In addition, relevant R&D work on monitoring internal affairs provided crucial evidence that a systematic approach to tracking developments within countries is both feasible and potentially productive.* These two streams both flow into the "Intranational Politics" arrow displayed in Figure 8-3.

The other major influence shown in Figure 8-3 is the international politics-oriented EWAMS. The concept of an <u>event</u> applies to both international and intranational politics. A modified EWAMS event coding scheme was developed for collecting data on internal affairs.

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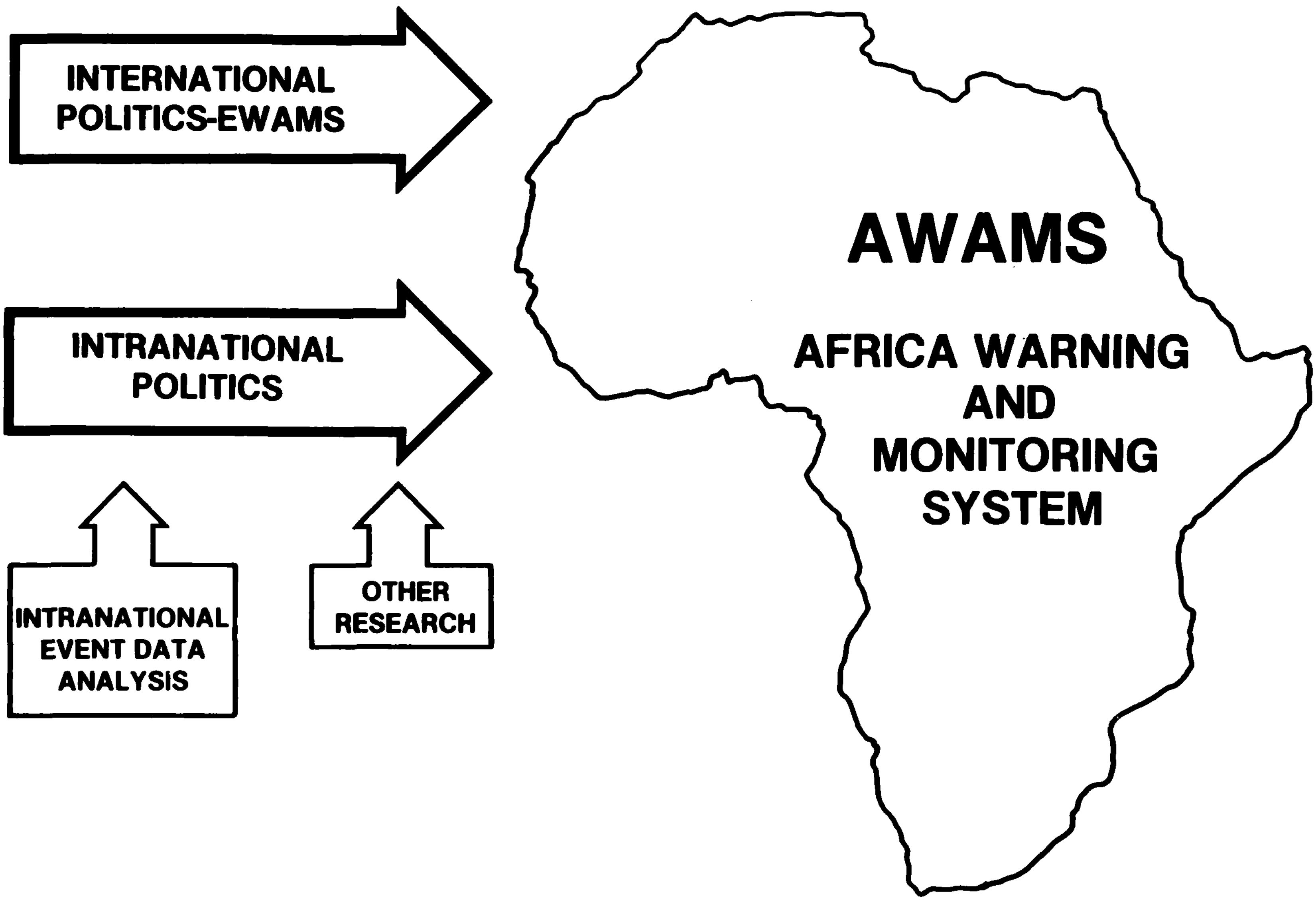
*See Slater and Orloski (1978).

Figure 8-3

SOURCES OF THE AFRICA SYSTEM



8.3.2 Data collection design. The key feature of the internal event data scheme consists of the actor-target concepts. In intranational political analysis, there are subnational actors (senders within countries) and subnational targets (recipients within countries). An example would be a group within the general or mass public (e.g., an isolated gathering) which protests against a policy promulgated by an actor within the government (e.g., the head of state).

The AWAMS subnational actors and targets correspond to EWAMS countries and other actors. There is an AWAMS (internal politics) event category scheme as well as one for EWAMS (international politics). Numerical codes are assigned to all of these discrete items. Figure 8-4 portrays the AWAMS data collection process.

The well known government/society dichotomy is an excellent conceptual beginning for delineating actors and targets within states because the relationship between the rulers and ruled is central to the analysis of interstate conflict and stability in all countries. Other relationships are also important: intra-governmental and intra-societal patterns may indicate tranquility or crisis for the polity as a whole. Therefore, a somewhat more elaborate conceptual division of political actors is desirable. Table 8-1 offers one such actor/target list.

Figure 8-4

AWAMS DATA COLLECTION PROCESS

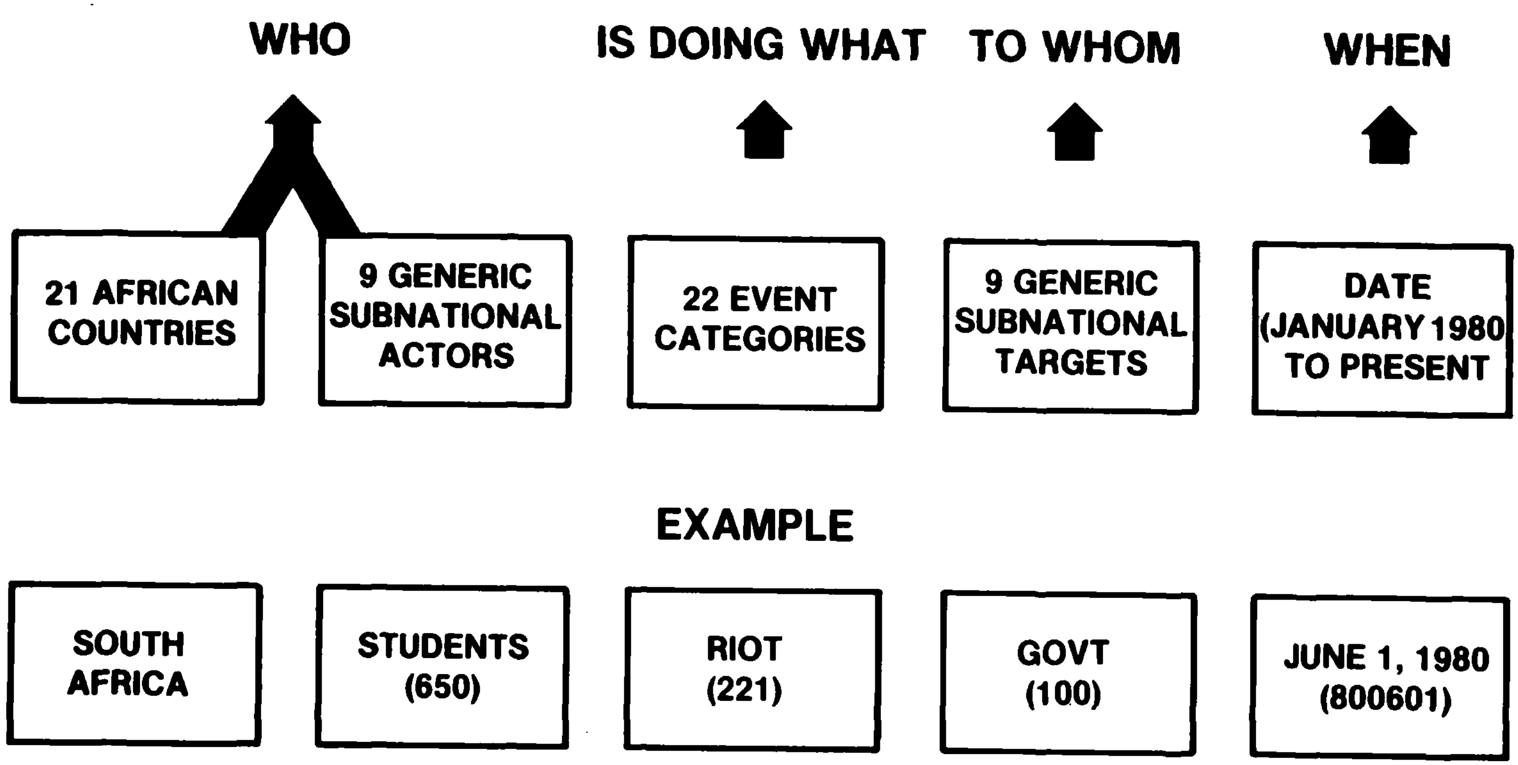


Table 8-1

A SUBNATIONAL ACTOR/TARGET SCHEME

100	GVT	Government		
		110	HOS	Head of State
		120	EXC	Executive Officials, Bureaucracy
		130	FOR	Foreign Ministry, Diplomatic Corps
		140	LEG	Legislature
		150	JUD	Judiciary
		160	LOC	Regional/Local
		190	GVO	Other
200	MIL	Military		
		210	ARM	Army
		220	AIR	Air Force
		230	NAV	Navy
		240	SEC	Domestic Security
		250	INT	Intelligence
		290	MLO	Other
300	RLP	Ruling Party/Organization		
		310	RPL	Leadership
		320	RPF	Factions
		330	RPM	Membership
		340	RPR	Regional/Local
		390	RPO	Other
400	OPP	Opposition/Party/Organization		
		410	OPL	Leadership
		420	OPF	Factions
		430	OPM	Membership
		440	OPR	Regional/Local
		450	EXM	Exiled Membership
		460	EXL	Exiled Leadership
		490	OPO	Other
500	MED	Media		
		510	NEW	Newspaper
		520	RTV	Radio-TV
		530	MRP	Govt., Ruling Party
		540	MOP	Opposition Party
		590	MOT	Other
600	MAS	Mass		
		610	NAG	National, Generalized
		620	NAS	National, Scattered
		630	ISO	Isolated Gathering
		640	REG	Regional/Local
		650	DIS	Students, Dissidents
		660	LIB	Liberation Organizations
		690	OTH	Other
700	SCG	Socio-Cultural Groups		
		710	REL	Religious, Church
		720	ETH	Tribal/Ethnic
		730	RAC	Racial
		740	ALN	Aliens, Refugees
		790	SCO	Other
800	LAB	Labor		
		810	UNL	Union/Federation
		820	NUL	Non-Union Group
		890	LBO	Other
900	BUS	Business		
		910	FIN	Financial
		920	IND	Industrial
		930	COR	Corporate Merchant
		940	PRO	Professional
		950	AGR	Agricultural
		990	BUO	Other
999	MIS	Miscellaneous		

The government and military are separated in this scheme in order to emphasize the role of the military in society. Each is subdivided into sub-actors as well in order to permit greater flexibility and provide for detail within the general scheme. Government is divided into the head of state and executive, legislative, and judicial components, as well as regional/local governments. The military includes the army, air force, navy, and domestic security components.

The ruling political party is separated from the government because this relationship is not always one of identity; indeed, the ruling party's relationship to the government (or one component therein) may be a source of conflict or instability, as is the case regarding intra-party relationships (factions, leadership/elites, membership interactions). Opposition political parties are similarly important and identifiable actors in intrastate politics; because a party is an organization whose chief avowed aim is the placement of its members into government positions, parties are unique actors in virtually all political systems.

The media play a special role in intrastate politics since they serve as communications channels among other actors and also interact politically on various issues. The structural arrangement linking the media to the government, parties, and other actors varies greatly across systems

and it is important to distinguish among such arrangements (independent, government-operated, party-operated).

The *mass* of the political system refers to the generally unorganized or informally organized collections of individuals. "Masses" may refer to the public in general, to scattered collections or gatherings across the nation, to an isolated grouping, or to a specific region-wide or local-wide collectivity (see Table 8-2). Students and dissidents are recognized as special cases because of their tradition as especially outspoken elements of the political "mass."

Table 8-2

TYPES OF MASS ACTORS

		TERRITORIAL COVERAGE	
		NATION-WIDE	LIMITED DOMAIN
PERMEATION OF CITIZENRY	UNDIFFERENTIATED GROUPING	GENERAL	REGIONAL/LOCAL
	DISTINGUISHABLE GROUPING	SCATTERED	ISOLATED

The "society" is comprised of parties, media, masses, and relevant interest groups and organizations (Slater and Orloski, 1978: 10). Often, interest groupings can be simply defined as part of the masses; however, *organized* (or semi-organized) *masses* should be recognized as special actors in political systems because they are both distinct in their relative capabilities and dealings with other actors and potent

(because of organization) in their abilities to cause change. Labor (union and non-union) and business (of various kinds) have a very important relationship with each other and with other political actors and often exert considerable organizational power. Socio-cultural groups (religion, race, ethnic/tribal) are also important and often organized segments of the population, normally exerting pressures regarding distributional policies (of power or wealth) which affect basic national unity; separation of race, religion, and ethnic/tribal groups is theoretically difficult but, in practice, quite feasible and desirable (e.g., racial versus tribal conflict in Africa).

Table 8-3 offers a modified WEIS events coding scheme for intrastate analysis. It draws upon the Slater/Orloski work, as well as various conflict event studies and comparative research conceptualizations, in order to include all relevant event-types within the broad categories. The latter are identical to the WEIS scheme with one minor exception: "expel" has been replaced by "ban," a more inclusive form of activity of this genre. Thus, the coding scheme is virtually identical to the WEIS scheme (facilitating coder training and compatibility/comparability in analyses) but includes as sub-categories the behavioral forms which are distinctively intrastate.

Table 8-3

EVENT CODING SCHEME FOR INTRASTATE DATA

1. YIELD
   - 011 Submit to penalty or arrest
   - 012 Return property, retreat
   - 013 Seek accommodation with
   - 014 Admit wrongdoing, retract
   - 015 Cede power to
2. COMMENT
   - 021 Decline to comment
   - 022 Comment on situation
   - 023 Explain situation or rights
   - 024 Explain policy or feelings
   - 025 Announce, provide data
   - 026 Fill or change position in (by appointment, election)
   - 027 Change rules or charter of
3. CONSULT
   - 031 Meet with, host or visit
   - 032 Communicate with, negotiate
   - 033 Vote, hold election or meeting
4. APPROVE
   - 041 Praise, honor, condolences
   - 042 Endorse or support
   - 043 Rally in support of
5. PROMISE
   - 051 Promise support or aid
   - 052 Assure or reassure
   - 053 Promise reform or rights
6. GRANT
   - 061 Apologize, express regret
   - 062 Invite, give asylum
   - 063 Grant rights, recognition
   - 064 Release captive or prisoner
   - 065 Suspend negative sanctions
   - 066 Grant position to (by appointment, election)
7. REWARD
   - 071 Give money or material aid
   - 072 Give assistance or other aid
8. AGREE
   - 081 Agree on issue or contract
   - 082 Agree to future cooperation
   - 083 Ally with
   - 084 Merge with
9. REQUEST
   - 091 Request information
   - 092 Request support or aid
   - 093 Request action or change
   - 094 Request rights or membership
10. PROPOSE
    - 101 Offer specific proposal
    - 102 Urge or suggest
11. REJECT
    - 111 Reject proposal, demand, or threat
    - 112 Refuse to allow, oppose
    - 113 Defy law, rule, command
12. ACCUSE
    - 121 Charge, blame, criticize
    - 122 Denounce, denigrate
    - 123 Investigate
13. PROTEST
    - 131 Complain, protest verbally
    - 132 Symbolic act of protest
14. DENY
    - 141 Deny attribution
    - 142 Deny accusation or claim
15. DEMAND
    - 151 Issue command, insist upon action or change
    - 152 Claim rights, insist upon obligations
16 WARN
    - 161 Warn against act, policy
    - 162 Warn of impending danger
17. THREATEN
    - 171 Threaten, unspecific
    - 172 Threaten, specific sanctions
    - 173 Ultimatum (time limitation)
18. DEMONSTRATE
    - 181 Protest demonstration
    - 182 Mobilize, move armed force
19. NEGATIVE SANCTIONS
    - 191 Cancel, postpone, halt
    - 192 Reduce or suspend aid or support
    - 193 Strike; harass; impose penalty
    - 194 Censor, reduce rights or access
    - 195 Resign from; secede from
20. BAN
    - 201 Exile, deport, fire, lock-out
    - 202 Close down, dissolve, purge, expel
21. SEIZE
    - 211 Seize possessions, position
    - 212 Arrest, detain, kidnap
22. FORCE
    - 221 Riot
    - 222 Destroy, demolish, bomb (non-injury)
    - 223 Assassinate, torture, execute
    - 224 Armed engagement or injurious bombing
    - 225 Coup, attempt coup

In order to establish the comprehensiveness of the event coding scheme, several major non-directional events--largely conflictual--can be compared to their counterparts in Table 8-3:

- Coups: a force act (225); actor may be military (200); target normally head of state (110).
- Constitutional Change: change rules (027); actor may be mass (500) through vote (033) regarding government (100).
- Executive Change: in election, mass (500) grants position (066) to a party leader (310 or 410) and appoints (026) head of state (110).
- Cabinet Change: usually the head of state (110) appoints (026) to executive (120); often also grants position (066) to some group (e.g., labor official [710]).
- Purge: usually the head of state (110) fires (201) executive official (120) or party leaders (310).

8.3.3 Indicator design. The prototype AWAMS indicators are patterned on those available to the user of the international EWAMS. Thus, internal affairs may be monitored on a daily, weekly, or monthly basis in terms of:

- Total activity
- Conflictual activity
- Cooperative activity
- Tension
- Uncertainty or complexity of relations

One potentially important change in the computation of these indicators should be noted. Whereas in international interactions events which are "comments" represent a form of cooperation (communication which is not hostile is generally viewed as a sign of cooperation), this is not necessarily true of comments exchanged within a country. The intrastate coding scheme intentionally codes all "neutral" events in one category (comment) and includes such actions as announcements and the filling of administrative vacancies. Such "neutral" events should be excluded from the cooperation activity indicator; they represent very ambiguous actions. However, the importance of these events as signals of activity recommends that they be included in the total activity indicator computation procedure.

The concept of <u>progressive z-scores</u> can also be transferred from interstate to intrastate indications development. This scoring procedure can be applied to any indicator in order to transform a "snapshot" portrayal into an historically grounded description of current events. By providing a measure of an indicator readings's unusualness when compared to prior readings, progressive z-scores will reflect the extent of change in interaction processes within a country, thereby standardizing indicators to country-specific contexts. Because differences across political structures are vast, this contextualization is of great importance in intrastate indicator development;

unfortunately, the utility of this indicator approach is severely limited for the near future because of a lack of retrospective data (upon which z-scores depend) in many event categories.

Other indicators of intrastate events may be culled from the especially rich format of the current data collection effort. Especially relevant is the repression index developed by Slater and Orloski (1978). By totaling the frequencies of events which are coded as repressive in the data base, the analyst is provided with an indicator which has been directly related to crisis warning.

A second feature of the data base is the "issue" code, which provides a context for the event descriptions (Slater and Orloski, 1978). This information can be employed in two ways to provide additional indications of intrastate activities.

First, the intrastate analyst should be provided with the option of selecting one or several issue contexts for delimiting the range of events to be considered; for example, the indicators of repression, conflict, tension, etc., can reference events concerning political issues, or economic issues, or any other set of issues rather than all issue-contexts combined. In this manner, the analyst may isolate the general problems which underlie observed event indicators.

The second use of "issue" information is the application of measures of variation (e.g., Hrel) to assess the degree to which activity is concentrated in a small number of issue categories or diffused across all issues; a plausible hypothesis regarding this type of indicator is that both extreme concentration and extreme diffuseness are indicative of governmental instability, while moderate concentration/diffuseness is normal in political communications.

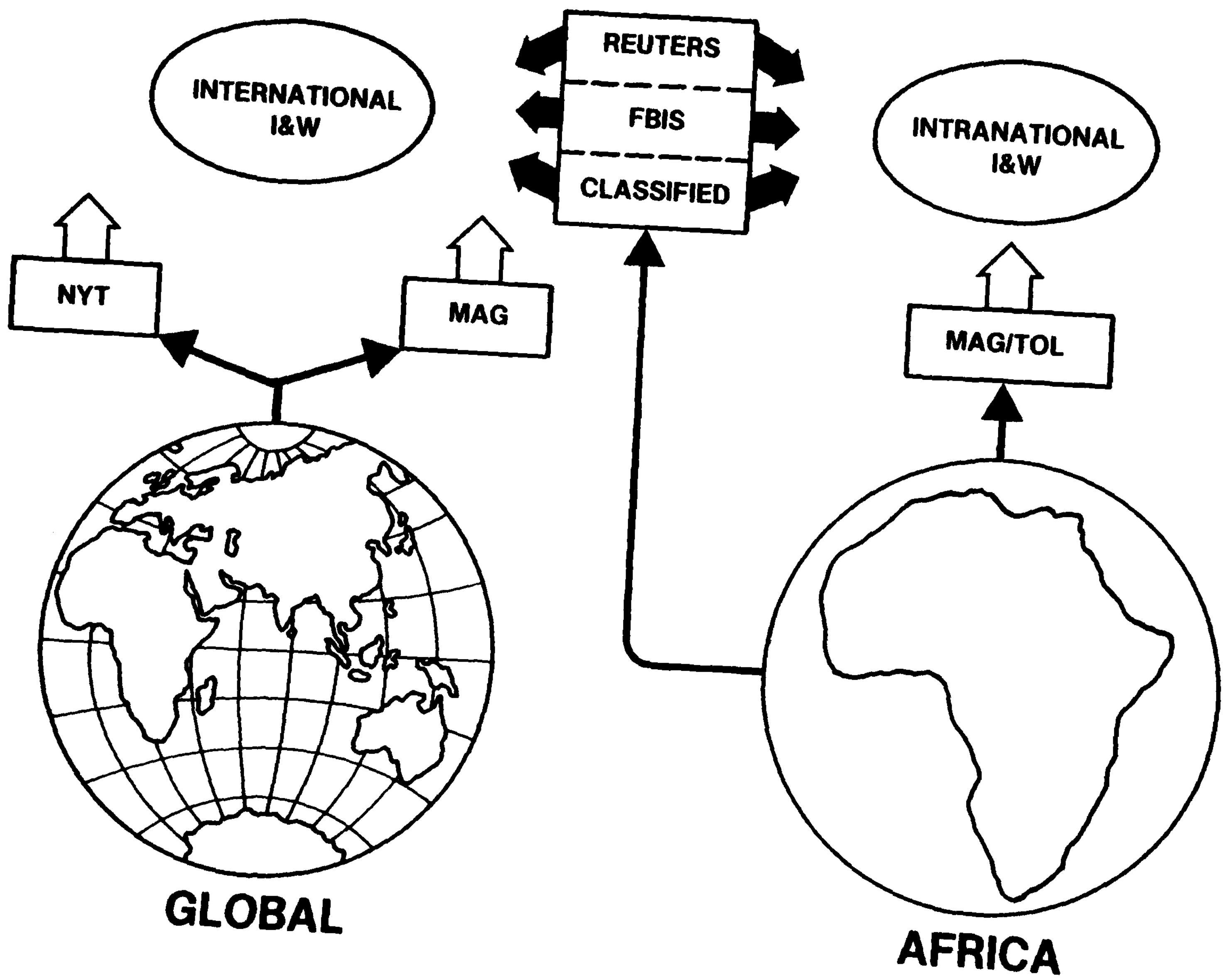
8.3.4 Prototype data base. In addition to the general framework, the data collection design, and the indicator design and the preliminary specification of indicators, empirical data are also being amassed. These data are for intranational affairs within and international relations involving sub-Saharan African countries.

The question of sources is central to the data base component of the prototype system. Figure 8-5 depicts the current and potential sources for the intranational (Africa) system, the international (Africa) system, and the international (global) system.* Currently, internal event data are amassed on a continuous and real-time basis from MAG/TOL (Manchester Guardian, Times of London), classified (cable traffic) data, and FBIS (the Foreign Broadcast

*The international (global) system refers to EWAMS, which includes international data on Africa as part of the overall system.

Figure 8-5

DATA SOURCES FOR AWAMS AND EWAMS: AN OVERVIEW



Information Service) data. Several months of Reuters data for African internal politics and interstate relations have also been collected in a pilot study.

8.3.5 Software. The software design and implementation for the prototype are proceeding on schedule. Thus far, there have been two noteworthy software accomplishments. First, the data entry software used for WEIS/EWAMS data has been revised to accommodate simultaneous intra- and international data entry. The original GEN software now exists as the modified GEN 2 software and is being used by IPPRC and has also been transferred to other DARPA/CTD contractors.

Secondly, the prototype AWAMS can be analyzed via software. Thus, the user may analyze subnational actors and targets for any country in the system; data may be displayed in tabular and graphic formats and textual retrievals are possible.

9.0 FUTURE RESEARCH

The prototype AWAMS (Africa Warning and Monitoring System) currently features two sources of data: MAG/TOL (Manchester Guardian/London Times) and FBIS (Foreign Broadcast Information Service).* The data cover the period from 800101 to the present. Future research directions will involve:

- Adding classified data
- Enhancing the prototype system
- Testing the data and indicators
- Devising and implementing an analytic strategy for intranational crisis warning

9.1 Source Performance

Our research on international politics suggests unequivocally that dual or multiple sources are both advisable and necessary. No data source is "perfect" or foolproof. To maximize hits and minimize misses and false alarms, it is crucial that data profiles be constructed from two (or more) sources of information.

Our preliminary comparisons of MAG/TOL and FBIS data on African internal affairs reinforce this conclusion.

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*In addition, Mathtech, Incorporated is collecting and analyzing cable traffic data (also under DARPA contract).

While it would be premature to offer firm generalizations, it is clear that the two sources together are better than either alone. FBIS seems to provide a more detailed portrait and therefore may be preferable for daily or weekly tracking; however, MAG/TOL yields patterns of interest and often confirms or complements FBIS. In other instances, MAG/TOL offers a unique picture of internal affairs in a given sub-Saharan African country.

Recently, software has been developed which permits the simultaneous graphic display of AWAMS data and indicators for any two sources.* This feature will be of value for our future work on comparative source performance.

9.2 Analytic Strategies

Quite a few potential analytic strategies are mapped out in Hopple and Slater (1980). These range from approaches for describing patterns in the data to methodologies for weighting, scaling, and otherwise transforming the raw data. Equally central will be the selection of a strategy for generating probabilistic internal crisis judgments.

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*Any two AWAMS or EWAMS sources may be so juxtaposed; refer to Figure 8-5 in the preceding section. The software was developed by Mark Waddell of the EWAMS computer science staff.

A problem with which event researchers have often been confronted is the selection of time periods for analysis. This has resulted in a greater emphasis on the use of weekly or daily indicators in EWAMS, as opposed to the more traditional monthly aggregations. The time period problem will become more complex as analysis of intranational events proceeds, since it is highly likely that such events will unfold in a far less systematic pattern--consequently, less conducive to monthly and possibly weekly analysis. The use of moving averages is suggested as a way to smooth the event pattern so that each day adds to our knowledge of the previous pattern without disturbing that pattern and without forcing the analysis into arbitrary and artificial intervals of time. Thus, in subsequent stages of the effort, moving averages (combined with some form of weighting such as exponential smoothing) should be incorporated into an intranational monitoring and warning system.

Scaling attempts to go beyond events viewed as simple frequency counts; weighting is designed to rectify the frequent criticism that the assignment of equal weights to event categories is both arbitrary and unjustified. In the analysis of intranational data, there have been numerous scaling studies.

Often, this has involved the use of factor analysis in an attempt to reduce discrete indicators to a smaller set

of more primordial dimensions. Prior research in this area has unearthed the intranational war versus the societal unrest or turmoil dimensions. Elite versus mass instability factors (e.g., coups versus mass political violence) have also frequently been inferred.

There are quite a few data-reduction and/or scaling techniques (factor analysis, Guttman scaling, etc.). The method of additive clustering or ADCLUS (see Shepard and Arabie, 1979) is a fairly recent alternative to the inherently continuous spatial models of multidimensional scaling and factor analysis and the strictly hierarchical models of discrete clustering. Clearly, intranational event data are neither continuous nor necessarily hierarchical in nature. ADCLUS subsumes hierarchical clustering as a special case and can be regarded as a discrete analogue of principal components analysis.

ADCLUS and alternative clustering approaches are designed to represent a set of discrete categories as a smaller collection of subsets. At the same time, clustering avoids the unfortunate tendency in political research to assume unidimensionality (e.g., the conflict-cooperation continuum).

Employing the semantic differential attitude measurement methodology, Calhoun (1971) transformed the WEIS

(World Event Interaction Survey) international event data <u>categories</u> into <u>weighted indicators</u>. As he contends, unweighted data often lead to the overemphasis of certain categories and the underemphasis of others. Expert judges were used to evaluate the basic WEIS event concepts across 41 standard bipolar (e.g., good-bad, strong-weak) adjective scales.

A similar approach to assigning weights to intranational event concepts could prove to be very productive. Vector geometry can be employed to describe event concepts in a spatial context. From the semantic differential judgments a variety of ways to rank and score event categories can be applied (for example, the absolute distance of the concepts from the origin of the semantic space, evaluation x potency, etc.).

The ADCLUS scaling and the semantic differential weighting approaches represent only two of many potential scaling and weighting options. In testing intranational indicators, a variety of candidate approaches could be experimented with.

A viable intranational I&W tracking system should build on the event data base of the prototype. Various cognate data bases can be considered; these will be discussed below.

Some of these are designed to facilitate the charting of more global trends, situations, conditions, states of affairs, and contexts.

"Objective" data (including event data) are sometimes referred to as "hard" data--in contrast with "soft" (expert-based or judgmental) data. Popular in past decades, expert-derived data were eclipsed by objective data in the 1960s and 1970s. In recent years, however, there has been a "renaissance" in the area of expert data (see Hopple and Kuhlman, 1980). The trend is toward the meshing of objective and subjective data.

From a purely pragmatic perspective, this trend is laudable because users of computer-based and other data systems are generally suspicious of hard data and comfortable with expert assessments. For successful transfers to the "user community," then, the inclusion of expert-based data can be expected to facilitate the process.

Interestingly, the use of judgmental data also attracts support from the vantage point of less applied research criteria. As a recent GAO (1980) critique of defense R&D concludes, "squishy" problems cannot be reduced to or handled completely by hard models; the assessment concluded that judgments should be incorporated into and synthesized with models. This implies that consideration should be

given to the enhancement of the prototype intranational data by incorporating subjective judgments.

Experts have always played a central role in academic international affairs and in applied national security and defense settings. Country and area specialists comprise a large cadre in the international and comparative politics research communities; State, DIA, CIA, and other components of the intelligence and national security analysis complex are often structured in terms of country desks and regional foci.

The burgeoning literature on political risk assessment within and for private corporations provides a backdrop and a point of departure for this discussion. Almost all of the extant political risk analysis frameworks and services rely on country and area experts, who may be academicians, consultants, retired Foreign Service or CIA personnel, or corporate executives with extensive experience abroad (see Haendel, 1979; Slater and Longo, 1980).

Whether used in an ad hoc or structured fashion (e.g., simply eliciting judgments, perhaps via a questionnaire and in terms of a checklist of factors, vs. Bayesian-based approaches), the political risk analyst relies on expertise. Although other approaches are used--including social scientific

techniques--the expert is the preferred and dominant "methodology" (Kobrin et al., 1980).

An apparent anomaly surfaces, however, when extensive evidence from psychology is introduced. An avalanche of data from behavioral decision theory research demonstrates that people exhibit a number of errors, biases, and fallacies when they evaluate evidence and make judgments. Furthermore, statistical models generally perform better than intuitive judgments--at least in certain areas.

Massive supportive evidence for the latter proposition was catalogued in Paul Meehl's 1954 book Clinical Versus Statistical Prediction: A Theoretical Analysis and A Review of the Evidence; Meehl reported that a proper linear model (e.g., simple regression analysis, discriminant function analysis) predicts a numerical criterion from numerical predictor variables more accurately than skilled experts. More recently, Dawes (1979) presents evidence that the same holds for an improper linear model (i.e., one in which the weights are chosen by some nonoptimal method--equality, intuitive weights, etc.). As Dawes (1979: 573) emphasized, however:

> The statistical model may integrate the information in an optimal manner, but it is always the individual (judge, clinician, subjects) who choose variables. Moreover, it is the human judge who knows the directional relationship between the predictor variables and the criterion of interest. . .

Dawes (1979) refers to <u>bootstrapping</u> as the process of building a proper linear model of an expert's judgments about an outcome criterion and then using the linear model rather than the judge. In a number of studies, bootstrapping has worked. Random linear models perform about as well as the judge-based models; the equal weighting model tends to perform better; the optimal linear model produces the best results in terms of validity. Although the research has not focused on political variables and the criterion variables have been short-term in nature, the evidence for integrating judgments and modeling is impressive.

Slater and Longo (1980) refer to the potential applicability of bootstrapping to political risk assessment. Similarly, the synthesis of expert judgments and modeling makes sense in the context of "I&W risk assessment."

Furthermore, other analogies between corporate risk assessment and intranational I&W can be drawn. For example, Gebelein et al. (1978) view political risk from a component perspective. Political risk is a global concept which subsumes civil disorder losses, external war losses, sudden expropriation, creeping expropriation, taxation changes, etc.

The I&W analyst is similarly concerned with a range of discrete risks; risk in general is equivalent to objective doubt regarding the outcome of a situation and can therefore

be regarded (and expressed) probabilistically (see Haendel, 1979). There are "risks" relating to illegal elite change (e.g., coups), unexpected mass-based regime change (e.g., revolutions), ongoing internal war, episodic unrest (terrorism, fluctuating communal instability, etc.), and lower-level instability (e.g., nonviolent collective protest). There are also "risks" associated with various types of policy change. Further, second-order crises should also be monitored and assessed (e.g., economic upheavals with subsequent possible ramifications in the spheres of policy, regime, and/or system change). All of this suggests that intranational I&W must take a broad view of political change and expand the dominant focus from visible, intense conflict to salient crisis, conflict, and change incidents and trends.

In attempting to assess the multitudinous aspects and instances of intranational political change, expert assessments should not be elicited in an ad hoc or unstructured manner. The judgment process should be anchored in a Bayesian framework. The relevance of Bayesian methodology to the I&W process, intelligence analysis in general, and forecasting is demonstrated in Andriole (1980), Barclay et al. (1977), Duncan and Job (1980), Heuer (1980), Job and Duncan (1980), Kelly (1972, 1973), and Kelly et al. (1977).

The Bayesian approach has been employed in DoD and CIA to analyze a number of problems which fall under the rubric

of "international politics." Among these are the Indo-Pakistan War of 1971, the Soviet invasion of Czechoslovakia, Sino-Soviet relations, Syria-Israeli relations, Rhodesia-Zimbabwe relations, and the likelihood of a Warsaw Pact invasion of the NATO sphere, a North Vietnamese attack on South Vietnam, and an Arab-Israeli war in the Middle East. The work of Duncan and Job (1980) especially implies that Bayesian analysis can be integrated with objective event/interaction data and transferred to the realm of intranational I&W; one of their two case studies, in fact, was the Rhodesia-Zimbabwe crisis arena, a classic example of a protracted civil war situation.

The Duncan-Job work is explicitly concerned with short-term forecasting; their focus is the probability of transition from state to state in a dyadic conflict arena (e.g., Israel-Syria). A stochastic Markovian methodology is employed in conjunction with Bayesian statistical inference procedures to produce a series of forecasts about the expected movement in a dyadic system (e.g., from overt hostility to war).

The adaptation of this approach or a variant of it to intranational I&W could be explored as a task of the second phase of research. The heart of Bayesian analysis--whether in the form of "basic Bayes" or "hierarchical Bayes"--is the revision of probability judgments on the basis of a stream of new, incoming information. Andriole (1980) and Heuer

(1980) catalogue a number of heuristic and other advantages of a Bayesian approach. Basic Bayes is ideal for short-term forecasting problems and hierarchical Bayes for complex, long-term problems.

A variety of both types of problems can be delineated in the intranational I&W analytical arena. A classic short-term situation is the unfolding of policy on a day-to-day basis in a period of heightened tension or crisis. More generic phenomena (e.g., long-term stabilization) could be structured and analyzed in terms of a hierarchical model. The nature of the I&W task, the characteristics of intranational intelligence analysis, and prior "successes" in international I&W all support the idea of experimenting with Bayesian inference models as part of the research effort.

The data banks of comparative and international politics have undergone a quantitative proliferation in recent years. With little or no additional data collection, we can amass a number of relevant data bases for the tracking and analysis of intranational affairs in Africa.

For both descriptive profiling and modeling, contextual data are indispensible. In contrast to dynamic event data, contextual data refer to trends, situations, and conditions. Such data can be used to anchor event data in a contextual framework.

I&W analysts could find such data useful for background purposes and for information display and retrieval purposes. When the situation "heats up" in a given country, for example, the analyst could retrieve descriptive data pertaining to a variety of characteristics. What are the recent economic trends? What are the major tribal and other ethnocultural groupings in the system? What is revealed by qualify of life and system performance indices?

For explanatory purposes, such data would be useful for examining the potential determinants of phenomena reflected in event data patterns and trends. Using World Handbook and similar data sets, it should be possible to construct and test a variety of models. Such models could be analyzed "in-house" by the contractors; if they were useful, they could be integrated into the intranational system and made available to users (with esoteric aspects made transparent). Examples of contextual data include:

- Economic data
- Attribute data
- Ethnicity data

Regarding the first, data from the Economic Series of the African Research Bulletin and other appropriate data (London Financial Times, etc.) could be amassed; the nexus between economic and political trends and states of affairs

could be illuminated. Rapkin and Avery (1980), Smythe (1980), and many others demonstrate the impact of economic phenomena on intrasocietal politics and stress.

There are various sociopolitical, demographic, and cultural attribute data sets, including one for 77 countries and 10 years collected under the auspices of DARPA/CTD (see Hopple, 1978; Wilkenfeld et al., 1980). Especially useful should be the recently updated World Handbook data and the Black Africa Handbook data.

The central role of ethnicity and nationality in the study of inter- and intranational politics is obvious (see e.g., Nielsson, 1980). Further, Africa is the most heterogeneous region in the world in terms of societal pluralism; many African nations have extensive tribal and other cleavages. For studying political change and stability, more use should be made of available ethnicity data.

APPENDIX A

SAMPLE OUTPUT

```
NUMBER 1 --- TEKTRONIX 4025
NUMBER 2 --- TEKTRONIX 4051/2
NUMBER 3 --- ANY HARDCOPY
NUMBER 4 --- UNIVAC 1652

Type the number of the terminal you are using:  2
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This section provides a detailed overview of the key elements of the analytic EWAMS, using the case of Ethiopia-Somalia for the time period from 770101 to 780630.

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******** EARLY WARNING AND MONITORING SYSTEM ********

     The Early Warning and Monitoring System is being developed
for the Defense Advanced Research Projects Agency's Cybernetics
Technology Division (DARPA/CTD) by the International Public
Policy Research Corporation (IPPRC).

     This version of the system shows how a computer-based warn-
ing system comprised of quantitative political indicators might
be used by intelligence analysts in "real-time" to monitor inter-
national affairs and forecast international crises. The analyst
can use the system to track single countries, country-pairs, JCS
regions, regions of his own creation, or the entire international
system. The system includes data from 1966 to the present so
that the analyst can do historical analyses if he so desires.

     The EWAMS consists of two basic modules: analytic I&W and
automated I&W. Available in the analytic EWAMS are quantitative
probabilities of crisis and conflict, tabular and textual mater-
ial, graphical output and keyword-based searches. The automated
module features warning and monitoring alert and conflict hot-
spots lists and historical searches.

                 ********************************

  Press RETURN to continue:
```

```
**** EARLY WARNING AND MONITORING SYSTEM ****

            ****  MASTER MENU  ****

          crisis - (analytical I&W)
          auto   - (automated I&W)
          cap    - (country activity profile)
          end    - (terminate execution)

      Type option after (%) for execution.

          % crisis
```

Recommended data sets for regions:

	NYT	MAG	FBIS
North America	X		
South America	X		
Western Europe		X	
Eastern Europe		X	
Middle East	X		
Africa		X	X
Asia	X	X	

Press RETURN to continue...

The data base graph shows which sources are preferred for all JCS regions. NYT (New York *Times*) and MAG (Manchester *Guardian*) data are available for all 7 regions; FBIS (Foreign Broadcast Information Service) data exist only for Africa.

```
Specify data source to be used:

    1. New York Times (660101 to present)
    2. Manchester Guardian (781002 to present)
    3. Foreign Broadcast Information Service
                   (800101 to present)          1
```

Source #1 (NYT) is selected.

```
*** EARLY WARNING AND MONITORING SYSTEM ACTIVATED ***

  Are your actors:
      1. Countries
      2. JCS regions
      3. Both           1

  Please select two countries(usa,usr):  eth,som

  Specify activity flow:
      0. one way (eth >>> som)
      1. one way (eth <<< som)
      2. two way (eth <-> som)  2

  Select time increment:
      1. daily
      2. weekly
      3. monthly
      4. quarterly
      5. yearly                 3

  Set time parameters(750101-771231):  770101-780630
```

These are the "input parameters" for the analysis: actors; activity flow; time increment; time parameters (start and end dates). All actors have three-letter codes (eth is Ethiopia and som is Somalia); see the Appendix for a complete list.

```
Do you wish to use special purpose indicators?(y/n): n
```

Special purpose indicators is a special feature of crisis; it is discussed in Hopple and Pulley (1979). See the Research Memorandum section of the Publications list in Appendix B.

```
P R O C E S S I N G
C O M P L E T E D

Number of events found:    163
Do you desire conflict probabilities?(y/n): y
```

A total of 163 events is found.

Conflictual Probability

Monthly 770101 - 780630 Source: NYT

ETHIOPIA <<<>>> SOMALIA

Date	Probability
770101	0.56
770201	0.89
770301	0.17
770401	0.17
770501	0.33
770601	0.31
770701	0.99
770801	0.96
770901	0.52
771001	0.23
771101	0.22
771201	0.19
780101	0.22
780201	0.25
780301	0.26
780401	0.20
780501	0.18
780601	0.20

Press RETURN to continue:

Conflict probabilities for each month are shown here. The actual crisis began in August. Note the precrisis warning in July (.99) and the earlier high probabilities of .56 (January) and .89 (February).

```
SYSTEM OPTIONS :

tables    -    (tabular output)
plots     -    (graphical output)
text      -    (textual output)
change    -    (change input parameters)
keyword   -    (text by keyword)
menu      -    (return to master menu)

Type option after (%) for execution.

% tables
```

Tabular data are requested.

Source: NYT

Monthly Activity
770101 - 780630

ETHIOPIA<<Two-Way>>SOMALIA

	Total Activity			Cooperative Activity			Conflictual Activity		
Date	number	z-score	prob	number	z-score	prob	number	z-score	prob
770101	1	6.40	0.66	0	0.00	0.23	1	6.40	0.56
770201	2	12.96	0.96	0	0.00	0.23	2	12.96	0.89
770301	0	-0.20	0.15	0	0.00	0.23	0	-0.20	0.17
770401	0	-0.20	0.15	0	0.00	0.23	0	-0.20	0.17
770501	1	2.86	0.35	0	0.00	0.23	1	2.86	0.33
770601	1	2.61	0.32	0	0.00	0.23	1	2.61	0.31
770701	16	42.81	0.99	2	6.86	0.91	14	37.43	0.99
770801	38	16.33	0.99	4	13.86	0.99	34	16.65	0.96
770901	36	6.02	0.63	5	7.78	0.94	31	5.81	0.52
771001	8	0.82	0.20	0	-0.23	0.21	8	0.96	0.23
771101	8	0.80	0.20	0	-0.23	0.21	8	0.94	0.22
771201	3	0.12	0.16	0	-0.23	0.21	3	0.17	0.19
780101	8	0.80	0.20	1	0.89	0.32	7	0.78	0.22
780201	14	1.60	0.25	3	3.10	0.60	11	1.38	0.25
780301	15	1.68	0.25	2	1.80	0.43	13	1.65	0.26
780401	5	0.31	0.17	0	-0.30	0.21	5	0.40	0.20
780501	2	-0.09	0.15	0	-0.30	0.21	2	-0.06	0.18
780601	5	0.31	0.17	0	-0.30	0.21	5	0.40	0.20

Press RETURN to continue:

Total activity, cooperation, and conflict frequencies and Z-scores are displayed for the period from January of 1977 through June of 1978. Note especially the July and August Z-scores and probabilities.

Source: NYT

Monthly Tension and Uncertainty
770101 - 780630

ETHIOPIA<<Two-Way>>SOMALIA

Date	Tension	Z-score	H-rel	Z-score
770101	28	6.40	0.000	0.00
770201	50	11.56	0.000	0.00
770301	0	-0.21	0.000	0.00
770401	0	-0.20	0.000	0.00
770501	28	3.14	0.000	0.00
770601	28	2.82	0.000	0.00
770701	82	8.12	0.422	6.86
770801	87	5.56	0.510	8.31
770901	83	4.13	0.564	6.10
771001	87	3.71	0.000	-0.25
771101	87	3.26	0.238	1.74
771201	66	2.14	0.206	1.41
780101	76	2.41	0.392	2.89
780201	73	2.14	0.541	3.80
780301	80	2.31	0.553	3.43
780401	80	2.16	0.341	1.76
780501	50	1.09	0.000	-0.40
780601	60	2.04	0.000	-0.40

For event frequencies enter "t" for tabular format or
"l" for list format, or press RETURN for menu. t

Tension shot up to 82 in July 1977 and to 87 in August 1977, remaining very high thereafter.

Source: NYT

Monthly Total Activity
770101 - 780630

ETHIOPIA<<Two-Way>>SOMALIA

Date	Discussion/ Cooperation	Commitment/ Cooperation	Verbal Conflict	Physical Conflict
770101	0	0	0	1
770201	0	0	0	2
770301	0	0	0	0
770401	0	0	0	0
770501	0	0	1	0
770601	0	0	1	0
770701	2	0	9	5
770801	4	0	13	21
770901	5	0	11	20
771001	0	0	0	8
771101	0	0	1	7
771201	0	0	1	2
780101	1	0	5	2
780201	3	0	4	7
780301	2	0	8	5
780401	0	0	3	2
780501	0	0	0	2
780601	0	0	0	5

Press RETURN to continue:

Event frequencies are displayed for two forms of cooperation (discussion and commitment) and two types of conflict (verbal and physical).

The cooperation total includes one or more specific event/interaction categories (yield, comment, etc.); the conflict total also consists of more detailed categories.

Press RETURN to continue:

Source: NYT

Monthly Cooperative Activity
770101 - 780630

ETHIOPIA<<Two-Way>>SOMALIA

Date	YLD	CMNT	CNSL	APPR	PRMS	GRNT	REWD	AGRE	RQST	PROP
770101	0	0	0	0	0	0	0	0	0	0
770201	0	0	0	0	0	0	0	0	0	0
770301	0	0	0	0	0	0	0	0	0	0
770401	0	0	0	0	0	0	0	0	0	0
770501	0	0	0	0	0	0	0	0	0	0
770601	0	0	0	0	0	0	0	0	0	0
770701	0	2	0	0	0	0	0	0	0	0
770801	0	4	0	0	0	0	0	0	0	0
770901	0	5	0	0	0	0	0	0	0	0
771001	0	0	0	0	0	0	0	0	0	0
771101	0	0	0	0	0	0	0	0	0	0
771201	0	0	0	0	0	0	0	0	0	0
780101	0	1	0	0	0	0	0	0	0	0
780201	0	3	0	0	0	0	0	0	0	0
780301	0	2	0	0	0	0	0	0	0	0
780401	0	0	0	0	0	0	0	0	0	0
780501	0	0	0	0	0	0	0	0	0	0
780601	0	0	0	0	0	0	0	0	0	0

Press RETURN to continue:

Event frequencies for the 10 cooperation categories are shown in this frame.

Source: NYT

Monthly Conflictual Activity
770101 - 780630

ETHIOPIA<<Two-Way>>SOMALIA

Date	RJCT	ACUS	PROT	DENY	DMND	WARN	THRT	DEMO	RDUC	EXPL	SEIZ	FRCE
770101	0	0	0	0	0	0	0	1	0	0	0	0
770201	0	0	0	0	0	0	0	0	0	0	0	2
770301	0	0	0	0	0	0	0	0	0	0	0	0
770401	0	0	0	0	0	0	0	0	0	0	0	0
770501	0	0	0	0	0	0	1	0	0	0	0	0
770601	0	1	0	0	0	0	0	0	0	0	0	0
770701	0	6	0	3	0	0	0	0	0	0	0	5
770801	1	8	0	2	0	2	0	1	0	0	2	18
770901	1	4	0	3	0	1	2	0	1	1	2	16
771001	0	0	0	0	0	0	0	0	0	0	0	8
771101	0	1	0	0	0	0	0	1	0	0	0	6
771201	0	0	0	1	0	0	0	0	0	0	0	2
780101	0	1	0	4	0	0	0	0	0	0	0	2
780201	0	3	0	1	0	0	0	2	0	0	1	4
780301	0	4	0	1	1	1	1	0	0	0	0	5
780401	0	2	0	0	0	0	1	0	0	0	0	2
780501	0	0	0	0	0	0	0	0	0	0	0	2
780601	0	0	0	0	0	0	0	0	0	0	0	5

Press RETURN for Menu.

Here the 12 conflict category frequencies are displayed.

```
SYSTEM OPTIONS :

tables    -    <tabular output>
plots     -    <graphical output>
text      -    <textual output>
change    -    <change input parameters>
keyword   -    <text by keyword>
menu      -    <return to master menu>

Type option after <%> for execution.

% plots
```

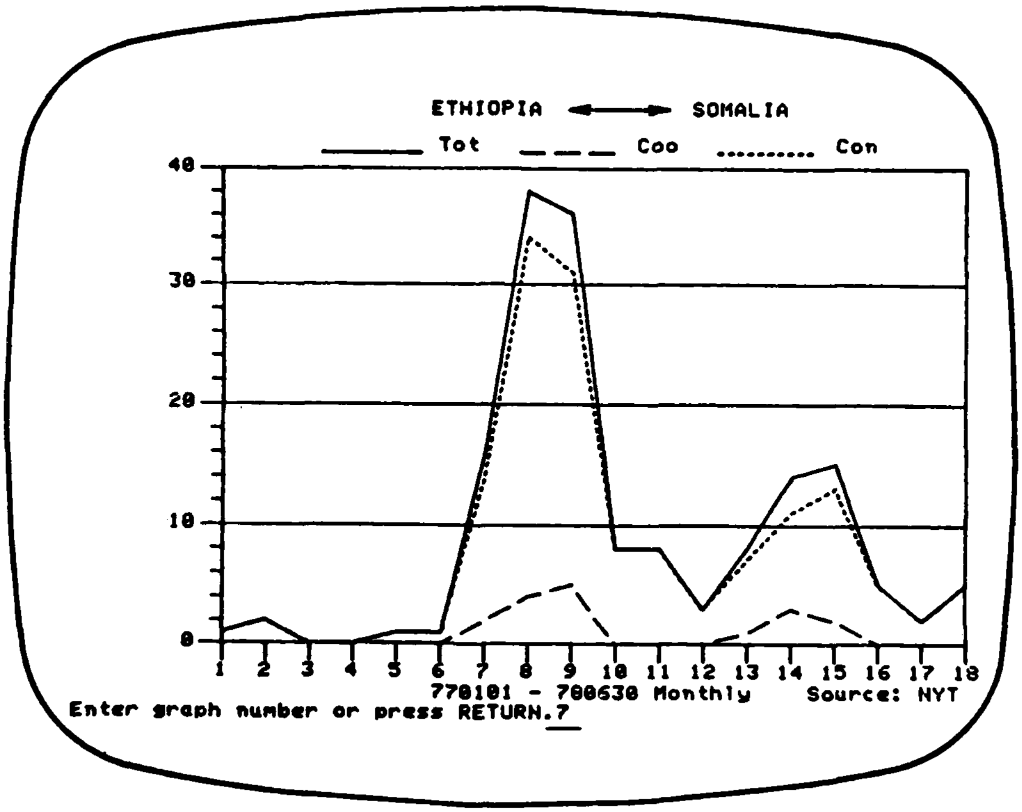
The user now requests plots, which show the tabular data in a graphic format.

POLITICAL INDICATORS

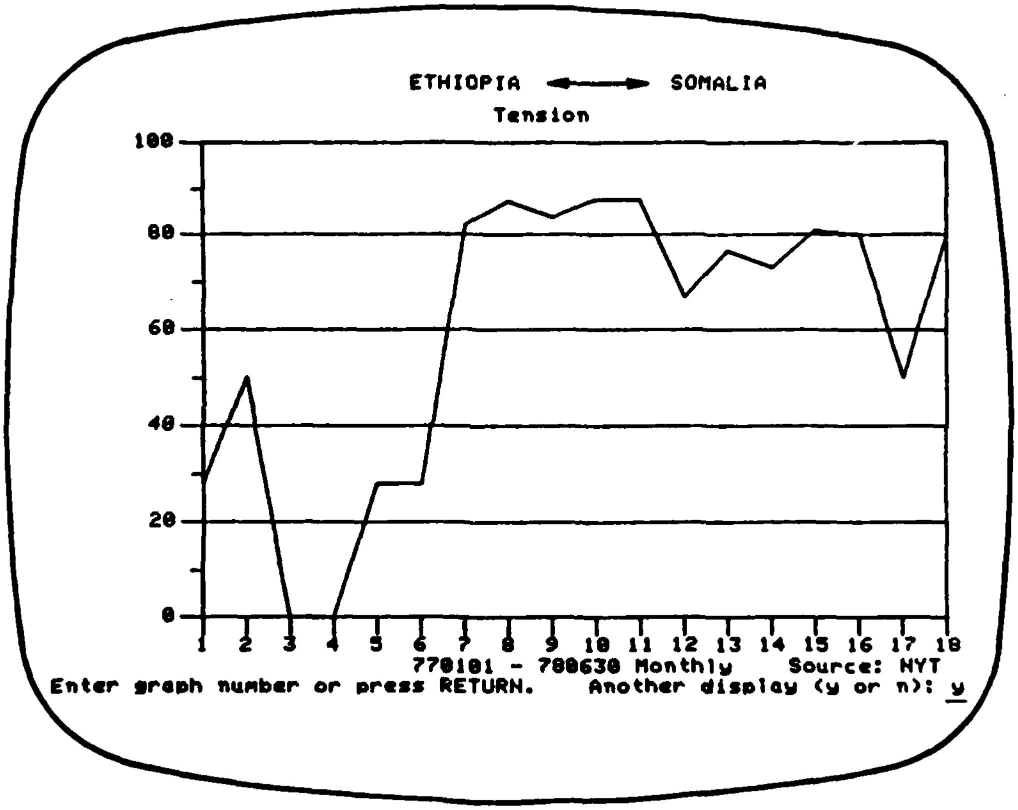
	Total Activity	Coop Activity	Conflict Activity	Tension Level	Uncert Level
Raw Data	1	3	5	7	9
Z-Score	2	4	6	8	0

```
Do you want more than one plot per graph (y or n)y
You have these choices:
      1 = graphs 1,3 + 5
      2 = graphs 2,4 + 6
      3 = graphs 7 + 9
      4 = graphs 8 + 10
Please pick one :    1
```

This is the basic plots menu. Here the user asks for a multiplot (#1), which will show total activity, cooperation, and conflict on a single graph.



The crisis in July and the war in August
are clearly revealed.



Tension rose in early 1977 (February), increasing again in June and especially July; the war continued through 1977 and into 1978, accounting for the uniformly high tension values.

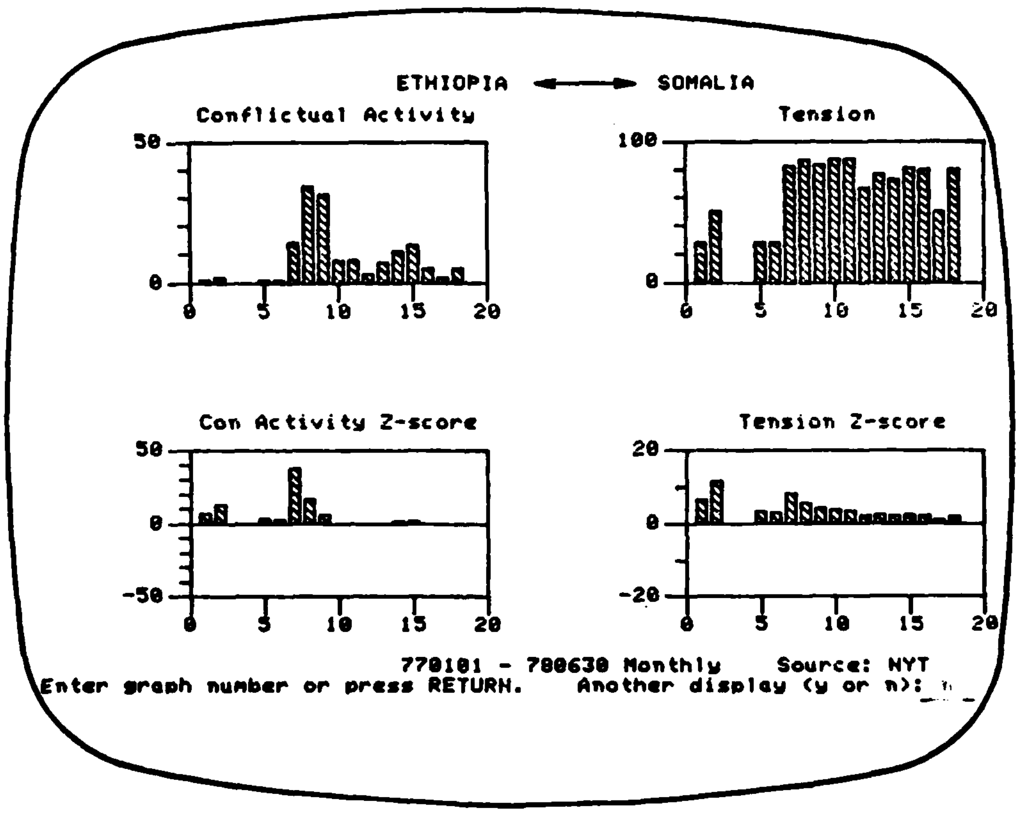
POLITICAL INDICATORS

	Total Activity	Coop Activity	Conflict Activity	Tension Level	Uncert Level
Raw Data	1	3	5	7	9
Z-Score	2	4	6	8	0

Do you want more than one plot per graph (y or n)n
Do you want graphs or shaded bar-charts (g or s) s
How many charts do you want (1-6) 4

Please type in the 4 chart numbers you
would like displayed in the form (1,2,3 ... 6) 5,6,7,8

Now the user requests four shaded bar-charts (conflict, conflict Z-score, tension, tension Z-score).



While the Z-scores provide warning of the developing crisis, the conflict activity and tension scores monitor the crisis and prolonged war from August on. The charts underline the different uses of various EWAMS indicators.

```
SYSTEM OPTIONS :

tables    -    <tabular output>
plots     -    <graphical output>
text      -    <textual output>
change    -    <change input parameters>
keyword   -    <text by keyword>
menu      -    <return to master menu>

Type option after (%) for execution.


% change
```

The change option is used to modify the input parameters.

```
                    *******  CHANGE   *******

Current input parameters:
    Actors: eth,som
    Flow: two way (eth <-> som)
    Time: 770101-780630 by month
    Source:  NYT
    SPI:  Normal

  Specify:
    a - change actors
    f - change flow
    t - change time
    s - change source
    i - change spi
    p - change all input parameters  t

Select time increment:
    1. daily
    2. weekly
    3. monthly
    4. quarterly
    5. yearly                2

Set time parameters(750101-771231):800801-800930
```

By using the time parameter change option, recent Ethiopia-Somalia interactions can be tracked. August and September 1980 weekly data are specified.

P R O C E S S I N G
C O M P L E T E D

Number of events found: 8

Press RETURN to continue:

```
        SYSTEM OPTIONS :

    tables    -    (tabular output)
    plots     -    (graphical output)
    text      -    (textual output)
    change    -    (change input parameters)
    keyword   -    (text by keyword)
    menu      -    (return to master menu)

Type option after (%) for execution.

              % text
```

The textual output option is specified.

```
          **********  TEXT  **********

Please Specify Event Types:

   1. All cooperative events
   2. All conflictual events
   3. All events
   4. Combination                  2

Set time parameters(750101-771231):  800801-800930
```

The user asks for #2 (all conflictual events). Note that start and end dates must always be specified in the text option.

```
Events: All Conflict                                              Source: NYT
Actors:                      ETHIOPIA<<->>SOMALIA
Dates:  800801 - 800930

date: 800809  actor: 530  event: 223  target: 520  arena:   0
     eth/som Ethiopian troops ambush a Somalian military
     convoy killing more than 1,300 Somalian soldiers.

date: 800811  actor: 520  event: 142  target: 530  arena:   0
     som/eth Somalia denies that its military forces were
     fighting in Ethiopia's Ogaden region, calling the Ethiopian
     accusation "baseless fabrication".

date: 800827  actor: 530  event: 223  target: 520  arena:   0
     eth/som Ethiopian troops backed by fighter-bombers attack
     the border of Somalia.

date: 800828  actor: 530  event: 142  target: 520  arena:   0
     eth/som Ethiopia denies that its troops had invaded Somalia
     and that the report was fabricated to get more USA aid
     for Somalia.

     Page full...press RETURN to continue
```

This and the following frame display the narrative text.

```
Events: All Conflict                                                Source: NYT
Actors:                          ETHIOPIA<<->>SOMALIA
Dates:  800801 - 800930

date: 800828  actor: 530  event: 121  target: 520  arena:   0
     eth/som Ethiopia accuses Somalia of fabricating reports of
     an Ethiopian attack in order to receive more USA aid.

date: 800901  actor: 530  event: 121  target: 520  arena:   0
     eth/som ETH assails the treaty between the USA and Somalia
     as a threat to the stability to the Horn of Africa.

date: 800921  actor: 530  event: 223  target: 520  arena:   0
     eth/som Ethiopian Mig-23's bomb and strafe targets
     in Somalia.

date: 800921  actor: 520  event: 121  target: 530  arena:   0
     som/eth Somalia accuses Ethiopia of using planes to
     bomb and strafe targets in Somalia.

       Do you want to look at more text (y/n):n
```

```
           SYSTEM OPTIONS :

     tables     -     (tabular output)
     plots      -     (graphical output)
     text       -     (textual output)
     change     -     (change input parameters)
     keyword    -     (text by keyword)
     menu       -     (return to master menu)

Type option after (%) for execution.


                % menu
```

Menu returns the user to the central EWAMS menu.

```
****** EARLY WARNING AND MONITORING SYSTEM ******


          ****  MASTER MENU  ****


          crisis - (analytical I&W)
          auto   - (automated I&W)
          cap    - (country activity profile)
          end    - (terminate execution)

     Type option after (%) for execution.

         % end
```

The user decides to terminate execution and therefore types in <u>end</u>.

APPENDIX B

EARLY WARNING AND MONITORING PROJECT

LIST OF PUBLICATIONS

EARLY WARNING AND MONITORING PROJECT

LIST OF PUBLICATIONS*

INTERNATIONAL EARLY WARNING AND MONITORING: RECENT RESEARCH MEMORANDA

RM 79-1-36	The Region Option in the Early Warning and and Monitoring System: Incorporating National Characteristics Regions Gerald W. Hopple January, 1979
RM 79-1-37	Real-Time Performance Evaluation Tests: Initial Findings and Further Tests Paul J. Rossa January, 1979
RM 79-1-38	Cross-National Crisis Indicators (CNCI) Data: State Sample, Variables, and Indices Gerald W. Hopple, Paul J. Rossa January, 1979
RM 79-1-39	Background Intelligence Data and the Government Foreign Affairs Analyst: An Overview Gerald W. Hopple, Paul J. Rossa January, 1979
RM 79-1-40	Crisis Forecasting Under Uncertainty: Proposal for a Two-Stage Forecasting Approach Thomas R. Davies February, 1979
RM 79-1-41	The Times of London/Manchester Guardian Data Base: Coding Procedures, Coder Reliability, and Quality Control Paul J. Rossa, Gerald W. Hopple February, 1979

*This publications list includes papers produced by past and current analysts on the Early Warning and Monitoring Project.

RM 79-1-42 The Times of London and the New York Times as Sources for the World Event Interaction Survey (WEIS) Data Base: A Comparative Profile
Gerald W. Hopple
February, 1979

RM 79-1-43 The Real-Time Performance of the Early Warning and Monitoring System: A Preliminary Assessment
Paul J. Rossa
February, 1979

RM 79-1-44 Recent Developments and Future Directions in International Crisis Research [Discussion Draft]
Gerald W. Hopple, Paul J. Rossa
March, 1979

RM 79-1-45 The Intelligent I&W Module in the Early Warning and Monitoring System: An Integrated Design
Gerald W. Hopple, Paul J. Rossa, Brenda Bell
March, 1979

RM 79-1-46 Indications, Probabilities, and Thresholds: Researching and Integrating the Political Component of the Early Warning and Monitoring System
Paul J. Rossa
March, 1979

RM 79-1-47 The Manchester Guardian Data Base as an Option in the Early Warning and Monitoring System: A Prolegomenon
Gerald W. Hopple
March, 1979

RM 79-1-48 The Diffusion of Political Conflict: Experimental Tests of a New Crisis Indicator
Thomas R. Davies
March, 1979

RM 79-1-49 Patterns Underlying Superpower Involvement in African Conflicts, 1966-1978
Paul J. Rossa, Gerald W. Hopple
April, 1979

RM 79-1-50 Economic Indicators in the Early Warning and Monitoring System: A Status Report
Gerald W. Hopple, Michael A. Daniels
April, 1979

RM-79-1-51 Intelligent I&W for the Early Warning and Monitoring System
Paul J. Rossa
May, 1979

RM 79-1-52 ROZ: An Update Report
Gerald W. Hopple
May, 1979

RM 79-1-53 Probabilistic Forecasts of International Crisis Through Discriminant Functions
Paul J. Rossa
June, 1979

RM 79-1-54 Historical Data for Crisis Analysis: World War II, The Korean War, and the Cuban Missile Crisis
Gerald W. Hopple
June, 1979

RM 79-1-55 Crisis Warning Through Unusualness Indicators: Comparing Alternative Historical Tails
Paul J. Rossa
June, 1979

RM 79-1-56 The Manchester Guardian Data Base: Intelligent I&W Tests
Gerald W. Hopple
June, 1979

RM 79-1-57 Special Purpose Indicators: Examples and Utility
Gerald W. Hopple and Marshall Pulley
July, 1979

RM 79-1-58 Understanding Probabilistic Crisis Forecasts
Paul J. Rossa
July, 1979

RM 79-1-59 The Country Activity Profile Indicator: A Comparison of 1976-1977 and 1978-1979
Gerald W. Hopple and Norman G. Snyder
August, 1979

RM 79-1-60 International Crisis Analysis: Recent Developments and Future Directions
Gerald W. Hopple
August, 1979

RM 79-1-61 The Keyword Option in the Analytic Early Warning and Monitoring System
Marshall Pulley and Gerald W. Hopple
September, 1979

RM 79-1-62 The Early Warning and Monitoring System Software: A Status Report
Marshall L. Pulley and Norman G. Snyder
October, 1979

RM 79-1-63	Evaluating Potential EWAMS Systemic Scans: The Event Flow Indicator (EFI) and the Pattern Recognition Algorithm (PRA) Frederick A. Rothe December, 1979
RM 80-1-64	Two Windows on the World: The <u>Manchester Guardian</u> and <u>New York Times</u> as Sources for the Early Warning and Monitoring System Gerald W. Hopple January, 1980
RM 80-1-65	Threat Networks: Digraph Theory and the 1971 India-Pakistan War Frederick A. Rothe January, 1980
RM 80-1-66	Early Warning and Monitoring System Performance: The Iranian Embassy Crisis of 1979 Paul J. Rossa January, 1980
RM 80-1-67	Crisis Probabilities in the Early Warning and Monitoring System: Use in Indications and Warnings Paul J. Rossa January, 1980
RM 80-1-68	Daily and Weekly Indicators in the Early Warning and Monitoring System: Use in Indications and Warnings Paul J. Rossa January, 1980
RM 80-1-69	Evaluating the Performance of the Early Warning and Monitoring System: A Design for Real-Time Testing and Assessment Frederick A. Rothe February, 1980
RM 80-1-70	Weekly Indicators for Crisis Warning: A Retrospective Study of Probabilistic Forecasting Potential in the Early Warning and Monitoring System Paul J. Rossa February, 1980
RM 80-1-71	Further Exploration of Threat Networks: The 1979 Iran and Afghanistan Episodes Frederick A. Rothe April, 1980

RM 80-1-72 Crisis Warning: A Comparison of the Manchester Guardian and New York Times
Gerald W. Hopple
April, 1980

RM 80-1-73 Moving Average Daily Indicators for Discriminant Function Probabilistic Crisis Forecasts
Paul J. Rossa
May, 1980

RM 80-1-74 Automated Crisis Warning and Monitoring: Exploring a Staircase Display Option
Gerald W. Hopple
September, 1980

INTRANATIONAL EARLY WARNING AND MONITORING: RECENT RESEARCH MEMORANDA

RM 79-3-1 An Intranational I&W Warning and Monitoring System for Africa: An Overview
Gerald W. Hopple
November, 1979

RM 79-3-2 An Intrastate Political Events Survey: A Data Collection Design
Paul J. Rossa
December, 1979

RM 80-3-3 The GEN2 System for Inter- and Intra-State Events Data
Paul J. Rossa and Norman G. Snyder
January, 1980

RM 80-3-4 Indicator Development for Intrastate Early Warning and Monitoring
Paul J. Rossa
March, 1980

RM 80-3-5 Strategies for the Analysis of Intranational Event Data
Gerald W. Hopple and Robert O. Slater
June, 1980

TECHNICAL REPORTS

TR 76-19 Progress Report on the Development of an Integrated Crisis Warning System
Stephen J. Andriole
December, 1976

TR 76-20 Software Design for an Interactive Crisis Early Warning Prototype System
James F. Wittmeyer
December, 1976

TR 76-21 Crisis and Crisis Forecasting: An Analytical Review of the Literature
Richard W. Parker
December, 1976

TR 78-17-39 The Early Warning and Monitoring System: A Progress Report
Judith Ayres Daly and Thomas R. Davies
July, 1978

TR 78-3-39 User's Guide to the Early Warning and Monitoring System
Thomas R. Davies and Brenda D. Bell
November, 1978

TR 79-A-1 User's Guide to the Early Warning and Monitoring System
Gerald W. Hopple and Brenda D. Bell
July, 1979

TR 80-A-2 European Command/Early Warning and Monitoring System User's Guide
Gerald W. Hopple
March, 1980

TR 80-A-3 European Command/Early Warning and Monitoring System Political Indicators Handbook
Gerald W. Hopple and Paul J. Rossa
March, 1980

TR 80-A-4 Internal and External Crisis Early Warning and Monitoring
Gerald W. Hopple
December, 1980

OTHER PUBLICATIONS

Books

1. Expert-Generated Data: Applications in International Affairs
Gerald W. Hopple and James A. Kuhlman (co-editors)
Boulder, CO: Westview.

Articles

1. Conceptualizing an Integrated Crisis Warning System
Stephen J. Andriole and Robert A. Young
Journal of Defense Research
Spring, 1977

2. The Development of a Prototype Crisis Early Warning System
Stephen J. Andriole and Robert A. Young
Journal of Defense Research
Spring, 1977

3. Toward the Development of an Integrated Crisis Warning System
Stephen J. Andriole and Robert A. Young
International Studies Quarterly
March, 1977

4. Examination of Basic and Applied International Crisis Research
Richard W. Parker
International Studies Quarterly
March, 1977

5. Computers and Crisis: Monitoring and Forecasting International Political Affairs
Stephen J. Andriole, Brenda D. Bell, Judith Ayres Daly, James F. Wittmeyer and Robert A. Young
The World Future Society Bulletin
January/February, 1978

6. Computerized Crisis Forecasting
Stephen J. Andriole and Judith Ayres Daly
Air Force Magazine
July, 1978

7. Recognizing Patterns of International Political Situations
Moshe Ben-Bassat, Frederick A. Rothe and Amos Freedy
IEEE Transactions on Systems, Man, and Cybernetics
August, 1980

Book Chapters

1. Threat and Foreign Policy Analysis: Assessing the Overt Behavior of States in Conflict
Gerald W. Hopple, Paul J. Rossa, Jonathan Wilkenfeld
Book:
Patrick J. McGowan and Charles W. Kegley, Jr. (eds.)

Threats, Weapons and Foreign Policy Behavior, Volume 5, Sage International Yearbook of Foreign Policy Studies. Beverly Hills, CA: Sage Publications.
1980

2. Elite Values and Foreign Policy Analysis: Preliminary Findings
Gerald W. Hopple
Book:
Lawrence S. Falkowski (ed.) Psychological Models in International Politics. Boulder, CO: Westview.
1979

Conference Papers

1. Decision Process Models and the Needs of Policy-Makers: Thoughts on the Foreign Policy Interface
Stephen J. Andriole
International Studies Association
Toronto, Canada, February, 1976

2. Bayes, Blalock, and Best Estimates
Stephen J. Andriole
Southern Political Science Association
Atlanta, Georgia, November, 1976

3. Crisis Early Warning in a Regional Subsystem: The Middle East Case
Judith Ayres Daly, Richard W. Parker
Society for General Systems Research
Denver, Colorado, February, 1977

4. Monitoring and Forecasting International Crises: The Use of Economic Indicators
Richard W. Parker
International Studies Association
St. Louis, Missouri, March, 1977

5. A Crisis Early Warning Prototype System
Judith Ayres Daly
39th MORS (Military Operations Research) Meeting
Annapolis, Maryland, June, 1977

6. Application of an Early Warning and Monitoring System: The Middle East
Judith Ayres Daly
International Studies Association
Washington, DC, February, 1978

7. Conflict and Tension in Israeli-Egyptian Political Relations: 1966-1978
Thomas R. Davies
International Society of Political Psychology
New York, New York, September, 1978

8. Recent Developments and Future Directions in International Crisis Research
Gerald W. Hopple, Paul J. Rossa
International Studies Association
Toronto, Canada, March, 1979

9. Competition and Confrontation: The Superpowers in Africa
Thomas R. Davies
International Studies Association
Toronto, Canada, March, 1979

10. The Dynamics of United States-Soviet Union Involvement in the Somalia-Ethiopia Conflict Arena, 1977-78
Thomas R. Davies
Southwestern Political Science Association
Dallas, Texas, March, 1979

11. Political Conflict and the Use of Military Force in International Crises
Thomas R. Davies
Midwest Political Science Association
Chicago, Illinois, April, 1979

12. Patterns Underlying United States-Soviet Union Involvement in African Conflicts, 1966-1978
Paul J. Rossa, Gerald W. Hopple
Midwest Political Science Association
Chicago, Illinois, April, 1979

APPENDIX C

LIST OF THOSE WHO HAVE VIEWED THE EARLY WARNING AND MONITORING SYSTEM DEMONSTRATION

LIST OF THOSE WHO HAVE VIEWED THE EARLY WARNING AND MONITORING SYSTEM DEMONSTRATION

Government Agencies

T. Belden, Intelligence Community Staff

B. Blechman, Department of State

C. Blong, Federal Emergency Management Agency

W. R. Broach, Defense Intelligence Agency

G. Bryan, Office of Naval Research

S. Buckley, National War College

L. Capone, Defense Communication Agency

D. A. Charvonia, Defense Advanced Research Projects Agency, Europe

S. L. D'Orazio, Defense Intelligence Agency

J. P. Duffy, Defense Intelligence Agency

R. Elliott, Department of State

L. D. Faurer, European Command (EUCOM)

J. Floyd, Defense Intelligence Agency

R. R. Fossum, Defense Advanced Research Projects Agency

R. M. Ghormley, Defense Communication Agency

M. Hayes, Defense Advanced Research Projects Agency

L. Hazlewood, Central Intelligence Agency

W. D. Henderson, Office of the Secretary of Defense

D. Howell, Department of State

J. L. Houlgate, Defense Intelligence Agency

B. B. Johnson, Defense Intelligence Agency

E. L. Johnson, Office of Naval Research

F. Kapper, Office of the Secretary of Defense

J. E. Kelly, Defense Intelligence Agency

G. W. Krieser, Defense Intelligence Agency

J. Levan, United States Air Force, Europe

H. Lobdell, National War College

D. Looft, Defense Advanced Research Projects Agency

D. Mahley, National War College

D. K. Malone, Defense Intelligence Agency

B. Marecic, Naval Postgraduate School

J. Markowitz, Central Intelligence Agency

A. Marshall, Office of the Secretary of Defense

J. Morgensten, Office of the Secretary of Defense

C. Moro, Naval Postgraduate School

J. A. Nagay, Office of Naval Research

C. H. Norton, Defense Intelligence Agency

J. R. Pettit, Defense Intelligence Agency

J. Robbins, Central Intelligence Agency

G. E. Ruhl, Defense Intelligence Agency

B. J. Schick, Central Intelligence Agency

R. G. Sherwin, Naval Postgraduate School

A. Smith, Central Intelligence Agency

J. E. Snyder, Defense Intelligence Agency

V. Spoto, Office of Commander-in-Chief, Atlantic Fleet, Norfolk (CINCLANT)

J. Stark, Office of the Chief of Naval Operations

J. Thomas, Central Intelligence Agency

R. Winterberg, Central Intelligence Agency

Research and Development Institutions

J. Ballentine, Systems Planning Corporation

M. Ben Bassat, Perceptronics, Incorporated

W. Beyers, Mitre Corporation

J. E. Bridge, PRC Information Sciences Company

A. Clark, TRW

A. Clarkson, Electromagnetic Systems Laboratories

D. Druckman, Mathtech, Incorporated

J. Fain, CACI, Incorporated

J. M. Fox, Decisions and Designs, Incorporated

R. Gerenz, Betac, Incorporated

D. Guertin, Exxon Corporation

R. Hayes, CACI, Incorporated

G. Heilmeier, Texas Instruments

W. Howard, Systems Planning Corporation

S. Kaplan, The Brookings Institution

B. Kelly, BDM Corporation

C. W. Kelly, Decisions and Designs, Incorporated

J. Kudzie, RCA Corporation

T. Marril, Computer Corporation of America

J. Paisley, Mitre Corporation

C. R. Peterson, Decisions and Designs, Incorporated

D. Poe, BDM Corporation

J. B. Rothnie, Computer Corporation of America

L. Russo, Exxon Corporation

W. Shawcross, Decisions and Designs, Incorporated

C. Sherbrook, Mathtech, Incorporated

R. O. Slater, Mathtech, Incorporated

S. Snyder, Computer Corporation of America

M. D. Van Orden, Decisions and Designs, Incorporated

A. R. Wagner, Analytical Assessments Corporation

B. Watson, Center for Naval Analyses

G. Weltman, Perceptronics, Incorporated

Colleges and Universities

R. Butterworth, Pennsylvania State University

S. Chan, University of Maryland

W. Domke, University of Michigan

G. T. Duncan, Carnegie-Mellon University

J. Gillespie, Indiana University

B. L. Job, University of Minnesota-Twin Cities

J. Kidd, University of Maryland

J. Kringen, University of Maryland

J. Kugler, Boston University

C. A. McClelland, University of Southern California

D. McCormick, University of Maryland

W. R. Martin, California State College/Dominguez Hills

J. F. K. Organski, University of Michigan

W. Phillips, University of Maryland

T. Weigele, Northern Illinois University

P. Werbos, University of Maryland

J. Wilkenfeld, University of Maryland

D. Zinnes, University of Illinois

REFERENCES

ANDRIOLE, S. J. (1980) "Computer-Based Forecasting Methodologies," pp. 57-91 in G. W. Hopple and J. A. Kuhlman (eds.) Expert-Generated Data: Applications in International Affairs. Boulder, CO: Westview.

_____ (1976) "Progress Report on the Development of an Integrated Crisis Warning System." Technical Report TR 76-19, December. McLean, VA: Decisions and Designs, Inc.

_____ and R. A. YOUNG (1977) "Toward the Development of an Integrated Crisis Warning System." International Studies Quarterly 21 (March): 107-150.

AZAR, E. A., S. H. COHEN, T. O. JUKAM, and J. McCORMICK (1972) "The Problem of Source Coverage in the Use of International Events Data." International Studies Quarterly 16 (September): 373-388.

BARCLAY, S., R. V. BROWN, C. W. KELLY, C. R. PETERSON, L. D. PHILLIPS, and J. SELVIDGE (1977) Handbook for Decision Analysis. McLean, VA: Decisions and Designs, Inc.

BANKS, A. S. (1972) "Patterns of Domestic Conflict: 1919-1939 and 1946-1966." Journal of Conflict Resolution 16 (March): 41-50.

_____ (1971) Cross-Polity Time-Series Data. Cambridge, MA: MIT Press.

BELL, B. D., G. W. HOPPLE, and P. J. ROSSA (1978) "The Early Warning and Monitoring System," pp. 146-166 in J. A. Daly (ed.) Proceedings of the DARPA/CTO Crisis Management Seminar. Arlington, VA: Defense Advanced Research Projects Agency (DARPA) Cybernetics Technology Office (CTO), October.

BURGESS, P. M. and R. W. LAWTON (1972) "Indicators of International Behavior: An Assessment of Events Data Research." International Studies Series, 02-010. Beverly Hills, CA: Sage.

BURROWES, R. (1974) "Mirror, Mirror, on the Wall: A Comparison of Sources of External Events Data," in J. N. Rosenau (ed.) Comparing Foreign Policies: Theories, Findings, and Methods. Beverly Hills, CA: Sage.

_____ and B. SPECTOR (1973) "The Strength and Direction of Relationships Between Domestic and External Conflict and Cooperation: Syria, 1961-67," pp. 294-321 in J. Wilkenfeld (ed.) Conflict Behavior and Linkage Politics. New York: David McKay.

BUTTERWORTH, R. L. (1976) Managing Interstate Conflict, 1945-74: Data with Synopses. Pittsburgh, PA: University of Pittsburgh, Center for International Studies.

CALHOUN, H. L. (1971) "The Measurement and Scaling of Event Data Using the Semantic Differential." Presented at the Annual Meeting of the Western Political Science Association. Albuquerque, New Mexico, April.

CAMPBELL, D. T. and D. W. FISKE (1959) "Convergent and Discriminant Validation by the Multitrait-Multimethod Matrix." Psychological Bulletin 56: 81-105.

CHAN, S. (1979) "The Intelligence of Stupidity: Understanding Failures in Strategic Warning." American Political Science Review 73 (March): 171-180.

CHOLAWSKY, E., J. McCOY, and B. L. JOB (1979) "Daily News Coverage of Southern Rhodesia-Zimbabwe: A Comparison of the Coverage of Four Sources." Research Report No. 3, August. Minneapolis: University of Minnesota, Duncan-Job ARPA Project.

CLARKSON, A., L. KRASNO, and J. KIDD (1980) "Indications and Warning Analysis Management Systems (IWAMS): A Design Study." Technical Report, March. Sunnyvale, CA: ESL, Incorporated.

COLLINS, J. N. (1973) "Foreign Conflict Behavior and Domestic Disorder in Africa," pp. 251-293 in J. Wilkenfeld (ed.) Conflict Behavior and Linkage Politics. New York: David McKay.

DAHL, R. A. (1961) Who Governs? Democracy and Power in an American City. New Haven: Yale University Press.

DALY, J. A. [ed.] (1978) Proceedings of the DARPA/CTO Crisis Management Seminar. Arlington, VA: Defense Advanced Research Projects Agency (DARPA) Cybernetics Technology Office (CTO), October.

_____ and S. J. ANDRIOLE (1979) "Problems of Applied Monitoring and Warning." Jerusalem Journal of International Relations 4: 31-74.

DALY, J. A. and B. BELL (1977) "Probability Tables." Early Warning and Monitoring Project, Research Memorandum 14, August. McLean, VA: Decisions and Designs, Inc.

DALY, J. A. and T. R. DAVIES (1978) "The Early Warning and Monitoring System: A Progress Report." Interim Technical Report PR 78-17-39, July. McLean, VA: Decisions and Designs, Incorporated.

DALY, J. A. and G. W. HOPPLE (1977) "Increasing the Sample for the Cross-National Crisis Indicators Project." Joint Research Memorandum 1, October. McLean, VA: Decisions and Designs, Incorporated.

DAWES, R. M. (1979) "The Robust Beauty of Improper Linear Models in Decision Making." American Psychologist 34 (July): 571-582.

DENTON, F. H. (1966) "Some Regularities in International Conflict." Background 9 (February): 283-296.

DONCHIN, E. (1979) "Event-Related Potentials: A Tool in the Study of Human Information Processing," in H. Begleiter (ed.) Evoked Potentials in Psychiatry. New York: Plenum Press.

DORAN, C. F., R. E. PENDLEY, and E. ANTUNES (1973) "A Test of Cross-National Event Reliability." International Studies Quarterly 17 (September): 175-204.

DUNCAN, G. T. and B. L. JOB (1980) "Probability Forecasting in International Affairs." Final Report, April. Pittsburgh, PA: Carnegie-Mellon University.

FEIERABEND, I. K. and R. L. FEIERABEND (1966) "Aggressive Behaviors Within Polities, 1948-1962: A Cross-National Study." Journal of Conflict Resolution 10 (September): 249-271.

_____ and T. R. GURR [eds.] (1972) Anger, Violence, and Politics: Theory and Research. Englewood Cliffs, N.J.: Prentice-Hall.

GAO (1980) Models, Data, and War: A Critique of the Foundation for Defense Analyses. PAD-80-21, March 12. Washington, D.C.: U.S. General Accounting Office.

GEBELIN, C. A., C. E. PEARSON, and M. SILBERGH (1978) "Assessing Political Risk of Oil Investment Ventures." Journal of Petroleum Technology (May): 725-730.

GEORGE, A., D. K. HALL, and W. R. SIMONS (1971) The Limits of Coercive Diplomacy. Boston: Little, Brown.

GERBNER, G. and G. MARVANYI (1977) "The Many Worlds of the World's Press." Journal of Communication (Winter).

GURR, T. R. (1970) Why Men Rebel. Princeton, N.J.: Princeton University Press.

_____ (1968a) "A Causal Model of Civil Strife: A Comparative Analysis Using New Indices." American Political Science Review 62 (December): 1104-1124.

_____ (1968b) "Psychological Factors in Civil Violence." World Politics 20 (January): 245-278.

_____, with C. RUTTENBERG (1967) "The Conditions of Civil Violence: First Tests of a Causal Model." Center for International Studies Research Monograph, 28 April. Princeton, N.J.: Princeton University.

GURR, T. R. and V. F. BISHOP (1976) "Violent Nations, and Others." Journal of Conflict Resolution 20 (March): 80-110.

GURR, T. R. and R. DUVALL (1973) "Civil Conflict in the 1960s: A Reciprocal Theoretical System with Parameter Estimates." Comparative Political Studies 6 (July): 135-169.

GURR, T. R. and M. I. LICHBACH (1979) "A Forecasting Model For Political Conflict within Nations," in J. D. Singer and M. D. Wallace (eds.) To Augur Well: Early Warning Indicators in World Politics. Beverly Hills, CA: Sage.

HAENDEL, D. (1979) Foreign Investments and the Management of Political Risk. Boulder, CO: Westview.

HAZELWOOD, L. A. (1975) "Diversion Mechanisms and Encapsulation Processes: The Domestic Conflict - Foreign Conflict Hypothesis Reconsidered," pp. 213-244 in P. J. McGowan (ed.) Sage International Yearbook of Foreign Policy Studies, Vol. III. Beverly Hills, CA: Sage.

_____ (1973) "Externalizing Systemic Stress: International Conflict as Adaptive Behavior," pp. 148-190 in J. Wilkenfeld (ed.) Conflict Behavior and Linkage Politics. New York: David McKay.

_____ and G. T. WEST (1974) "Bivariate Associations, Factor Structures, and Substantive Impact: The Source Coverage Problem Revisited." International Studies Quarterly 18 (September): 317-337.

HEUER, R. J. (1980) "Applications of Bayesian Inference in Political Intelligence," pp. 93-121 in G. W. Hopple and J. A. Kuhlman (eds.) Expert-Generated Data: Applications in International Affairs. Boulder, CO: Westview.

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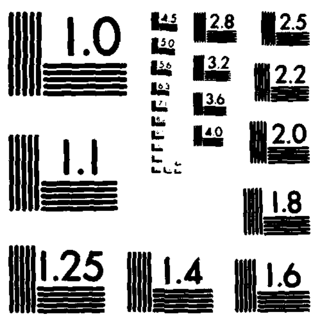

MICROCOPY RESOLUTION TEST CHART

HIBBS, D. A., Jr. (1973) Mass Political Violence: A Cross-National Causal Analysis. New York: John Wiley.

HILL, G. A. and P. H. FENN (1974) "Comparing Event Flows - The New York Times and The Times of London: Conceptual Issues and Case Studies." International Interactions 1: 163-186.

HOPPLE, G. W. (1980a) "Crisis Warning: A Comparison of the Manchester Guardian and New York Times." Early Warning and Monitoring Project, Research Memorandum 80-1-72, April. McLean, VA: IPPRC.

_____ (1980b) Political Psychology and Biopolitics: Assessing and Predicting Elite Behavior in Foreign Policy Crises. Boulder, CO: Westview.

_____ (1980c) "Two Windows on the World: The Manchester Guardian and New York Times as Sources for the Early Warning and Monitoring System." Early Warning and Monitoring Project, Research Memorandum 80-1-64, January. McLean, VA: IPPRC.

_____ (1979a) "The Manchester Guardian Data Base as an Option in the Early Warning and Monitoring System: A Prolegomenon." Early Warning and Monitoring Project, Research Memorandum 79-1-47, March. McLean, VA: IPPRC.

_____ (1979b) "The Manchester Guardian Data Base: Intelligent I&W Tests." Early Warning and Monitoring Project, Research Memorandum 79-1-56, June. McLean, VA: IPPRC.

_____ (1979c) "The Times of London and the New York Times as Sources for the World Interaction Survey (WEIS) Data Base: A Comparative Profile." Early Warning and Monitoring Project, Research Memorandum 79-1-42, February. McLean, VA: IPPRC.

_____ (1978) "Final Report of the Cross-National Crisis Indicators Project." Final Technical Report, December. College Park, MD: University of Maryland.

_____ and J. A. KUHLMAN [eds.] (1980) Expert-Generated Data: Applications in International Affairs. Boulder, CO: Westview.

HOPPLE, G. W. and P. J. ROSSA (1980) "International Crisis Analysis: A Review and Assessment," in D. Zinnes and T. Hopmann (eds.) Cumulation in International Relations. Denver, CO: University of Denver Monograph Series in World Affairs.

HOPPLE, G. W. and R. O. SLATER (1980) "Strategies for the Analysis of Intranational Event Data." Early Warning and Monitoring Project, Research Memorandum 80-3-5, June. McLean, VA: IPPRC.

HOPPLE, G. W. and M. PULLEY (1979) "Special Purpose Indicators: Examples and Utility." Early Warning and Monitoring Project, Research Memorandum 79-1-57, July. McLean, VA: IPPRC.

HOPPLE, G. W. and N. G. SNYDER (1979) "The Country Activity Profile Indicator: A Comparison of 1976-1977 and 1978-1979." Early Warning and Monitoring Project, Research Memorandum 79-1-59, August. McLean, VA: IPPRC.

HOPPLE, G. W., P. J. ROSSA, and B. D. BELL (1979) "The Intelligent I&W Module in the Early Warning and Monitoring System: An Integrated Design." Early Warning and Monitoring Project, Research Memorandum 79-1-45, March. McLean, VA: IPPRC.

HOPPLE, G. W., J. WILKENFELD, P. J. ROSSA, and R. N. McCAULEY (1977) "Societal and Interstate Determinants of Foreign Conflict." Jerusalem Journal of International Relations 2 (Summer): 30-66.

HUDSON, M. C. (1970) "Conditions of Political Violence and Instability: A Preliminary Test of Three Hypotheses." Beverly Hills, CA: Sage.

IPPRC (1980a) European Command/Early Warning and Monitoring System Political Indicators Handbook. Early Warning and Monitoring Project, Technical Report, March. McLean, VA: IPPRC.

_____ (1980b) European Command/Early Warning and Monitoring System User's Guide. Early Warning and Monitoring Project, Technical Report, March. McLean, VA: IPPRC.

_____ (1980c) Early Warning and Monitoring System: Sample Output. Early Warning and Monitoring Project, October. McLean, VA: IPPRC.

_____ (1979) Early Warning and Monitoring System: Sample Output. Early Warning and Monitoring Project, June. McLean, VA: IPPRC.

JACKMAN, R. W. (1978) "The Predictability of Coups d'etat: A Model with African Data." American Political Science Review 72 (December): 1262-1275.

_____ and W. A. BOYD (1979) "Multiple Sources in the Collection of Data on Political Conflict." American Journal of Political Science 23 (May): 434-459.

JACOBSON, A. L. (1973a) "Intrasocietal Conflict: A Preliminary Test of a Structural Level Theory." Comparative Political Studies 6 (April): 62-83.

_____ (1973b) "Measuring Intrasocietal Conflict." Sociological Methods and Research 4 (May): 440-461.

JOB, B. L. and G. T. DUNCAN (1980) "Probability Forecasts in International Affairs," pp. 233-268 in G. W. Hopple and J. A. Kuhlman (eds.) Expert-Generated Data: Applications in International Affairs. Boulder, CO: Westview.

KEGLEY, C. W., Jr., N. R. RICHARDSON and G. RICHTER (1978) "Conflict at Home and Abroad: An Empirical Extension." Journal of Politics 40 (August): 742-751.

KELLY, C. W., III (1973) "A General Bayesian Model for Hierarchical Inference." Organizational Behavior and Human Performance 10: 388-403.

_____ (1972) "Application of Bayesian Procedures to Hierarchical Inferences." Unpublished Ph.D. Dissertation, University of Michigan.

_____, R. R. STEWART, and J. O. CHINNIS, Jr. (1977) "Computer-Based Analytic Aids Program for Intelligence Analysts." Final Technical Report PR 77-8-42, September. McLean, VA: Decisions and Designs, Inc.

KOBRIN, S. J., with J. BASEK, S. BLANK, and J. LaPALOMBARA (1980) "The Assessment and Evaluation of Non-Economic Environments by American Firms: A Preliminary Report." Journal of International Business Studies (Spring/Summer).

LIAO, K. (1976) "Linkage Politics in China: Internal Mobilization and Articulated External Hostility in the Cultural Revolution, 1967-1969." World Politics 28 (July): 590-610.

LOWI, T. J. (1967) "Making Democracy Safe for the World: National Politics," pp. 295-331 in J. N. Rosenau (ed.) Domestic Sources of Foreign Policy. New York: Free Press.

McCLELLAND, C. A. (1976) "Warnings in the International Event Flow: EFI and ROZ as Threat Indicators." Technical Report, International Relations Research Institute, July. Los Angeles, CA: University of Southern California.

_____ (1972) "The Beginning, Duration, and Abatement of International Crises: Comparisons in Two Conflict Arenas," pp. 83-108 in C. F. Hermann (ed.) International Crises: Insights from Behavioral Research. New York: Free Press.

_____ (1968) "Access to Berlin: The Quantity and Variety of Events, 1948-1963," pp. 159-186 in J. D. Singer (ed.) Quantitative International Politics: Insights and Evidence. New York: Free Press.

MAHONEY, R. B., Jr. (1978) "Analysis of the Soviet Crisis Management Experience." Interim Technical Report, May. Arlington, VA: CACI, Incorporated.

MARTINO, J. P. (1972) Technological Forecasting for Decision-Making. New York: American Elsevier.

MOORE, J. A. et al. (1975) "Crisis Inventory." Final Report, August. Arlington, VA: CACI, Incorporated.

MORRISON, D. G. (1974) "Discriminant Analysis," pp. 2-442-2-457 in R. Ferber (ed.) Handbook of Marketing Research. New York: McGraw-Hill.

MORRISON, D. G., R. C. MITCHELL, J. N. PADEN, and H. M. STEVENSON (1972) Black Africa: A Comparative Handbook. New York: Free Press.

MORSE, E. L. (1972) "Crisis Diplomacy, Interdependence, and the Politics of International Economic Relations," pp. 123-150 in R. Tanter and R. H. Ullman (eds.) Theory and Policy in International Relations. Princeton, N.J.: Princeton University Press.

MULLER, E. N. (1979) Aggressive Political Participation. Princeton, N.J.: Princeton University Press.

_____ (1977) "Mass Politics: Focus on Participation." American Behavioral Scientist 21 (September/October): 63-86.

NIELSSON, G. P. (1980) "Toward Systematic Comparative Analysis of Nation-Groups as a Unit of Analysis in the Study of Intra-State Political Integration and Inter-State Relations." Presented at the Annual Meeting of the International Studies Association. Los Angeles, CA, March.

ORLANSKY, J. (1970) "The State of Research on Internal War." Research Paper P-565, August. Arlington, VA: Institute for Defense Analyses, Science and Technology Division.

PARVIN, M. (1973) "Economic Determinants of Political Unrest: An Econometric Approach." Journal of Conflict Resolution 17 (June): 271-296.

PETERSON, S. (1979) "Foreign News Gatekeepers and Criteria of Newsworthiness." Journalism Quarterly 55: 116-125.

_____ (1975) "Research on Research: Events Data Studies, 1961-1972," pp. 263-309 in P. J. McGowan (ed.) Sage International Yearbook of Foreign Policy Studies, Vol. III. Beverly Hills, CA: Sage.

RAPKIN, D. P. and W. P. AVERY (1980) "An Inventory of Relationships Between Economic and Political Instability." Presented at the Annual Meeting of the International Studies Association. Los Angeles, March.

ROSSA, P. J. (1980a) "Daily and Weekly Indicators in the Early Warning and Monitoring System: Use in Indications and Warnings." Early Warning and Monitoring Project, Research Memorandum 80-1-68, January. McLean, VA: IPPRC.

_____ (1980b) "Early Warning and Monitoring System Performance: The Iranian Embassy Crisis of 1979." Early Warning and Monitoring Project, Research Memorandum 80-1-66, January. McLean, VA: IPPRC.

_____ (1980c) "Moving Average Daily Indicators for Discriminant Function Probabilistic Crisis Forecasts." Early Warning and Monitoring Project, Research Memorandum 80-1-73, May. McLean, VA: IPPRC.

_____ (1980d) "Weekly Indicators for Crisis Warning: A Retrospective Study of Probabilistic Forecasting Potential in the Early Warning and Monitoring System." Early Warning and Monitoring Project, Research Memorandum 80-1-70, February. McLean, VA: IPPRC.

_____ (1979a) "Crisis Warning Through Unusualness Indicators: Comparing Alternative Historical Tails." Early Warning and Monitoring Project, Research Memorandum 79-1-55, June. McLean, VA: IPPRC.

_____ (1979b) "Indications, Probabilities, and Thresholds: Researching and Integrating the Political Component of the Early Warning and Monitoring System." Early Warning and Monitoring Project, Research Memorandum 79-1-46, March. McLean, VA: IPPRC.

_____ (1979c) "Probabilistic Forecasts of International Crises Through Discriminant Functions." Early Warning and Monitoring Project, Research Memorandum 79-1-53, June. McLean, VA: IPPRC.

ROTHE, F. (1980a) "Further Exploration of Threat Networks: The 1979 Iran and Afghanistan Episodes." Early Warning and Monitoring Project, Research Memorandum 80-1-71, April. McLean, VA: IPPRC.

_____ (1980b) "Threat Networks: Digraph Theory and the 1971 India-Pakistan War." Early Warning and Monitoring Project, Research Memorandum 80-1-65, January. McLean, VA: IPPRC.

_____ (1979) "Evaluating Potential EWAMS Systemic Scans: The Event Flow Indicator (EFI) and the Pattern Recognition Algorithm (PRA)." Early Warning and Monitoring Project, Research Memorandum 79-1-63, December. McLean, VA: IPPRC.

RUMMEL, R. J. (1963) "Dimensions of Conflict Behavior Within and Between Nations." General Systems Yearbook 8: 1-50.

SCOLNICK, J. M., Jr. (1974) "An Appraisal of Studies of the Linkage Between Domestic and International Conflict." Comparative Political Studies 6 (January): 485-509.

SEMMEL, A. K. (1979) "The Elite Press, Foreign News, and Public Opinion." Presented at the Annual Meeting of the International Studies Association. Toronto, Canada, March.

SHEPARD, R. N. and P. ARABIE (1979) "Additive Clustering: Representation of Similarities as Combinations of Discrete Overlapping Properties." Psychological Review 86 (March): 87-123.

SIGELMAN, L. and M. SIMPSON (1977) "A Cross-National Test of the Linkage Between Economic Inequality and Political Violence." Journal of Conflict Resolution 22 (March): 105-128.

SINGER, J. D. and M. D. WALLACE [eds.] (1979) To Augur Well: Early Warning Indicators in World Politics. Beverly Hills, CA: Sage.

SLATER, R. O. and M. LONGO (1980) "Political Risk Assessment: Evaluation and Alternatives." Presented at the Annual Meeting of the International Studies Association. Los Angeles, CA, March.

SLATER, R. O. and L. ORLOSKI (1978) "Governmental Change Indicators." Final Report M-13, September. Bethesda, MD: Analytic Support Center, Mathtech, Inc.

SMYTHE, E. (1980) "Foreign Involvement, Foreign Policy and Inter-state Relations: Towards a Propositional Inventory." Presented at the Annual Meeting of the International Studies Association. Los Angeles, CA, March.

SNYDER, D. (1978) "Collective Violence: A Research Agenda and Some Strategic Considerations." Journal of Conflict Resolution 22 (September): 499-534.

STECH, F. J. (1979) "Political and Military Intention Estimation." Final Report, November. Bethesda, MD: Mathtech, Inc.

STOHL, M. (1975) "War and Domestic Political Violence: The Case of the United States 1890-1970." Journal of Conflict Resolution 19 (September): 379-416.

TANTER, R. (1966) "Dimensions of Conflict Behavior Within and Between Nations, 1958-60." Journal of Conflict Resolution (March): 41-64.

THOMPSON, W. R. (1979) "Definitional and Dating Problems in the Analysis of International Crises." Early Warning and Monitoring Project, Technical Assessment Report 79-2-2, January. McLean, VA: IPPRC.

WILKENFELD, J. (1975) "A Time-Series Perspective on Conflict in the Middle East," pp. 177-212 in P. J. McGowan (ed.) Sage International Yearbook of Foreign Policy Studies, Vol. III. Beverly Hills, CA: Sage.

_____ (1973) "Domestic and Foreign Conflict," pp. 107-123 in J. Wilkenfeld (ed.) Conflict Behavior and Linkage Politics. New York: David McKay.

_____ (1969) "Some Further Findings Regarding the Domestic and Foreign Conflict Behavior of Nations." Journal of Peace Research 2: 147-156.

_____, G. W. HOPPLE, P. J. ROSSA, AND S. J. ANDRIOLE (1980) Foreign Policy Behavior. Beverly Hills, CA: Sage.

WILKENFELD, J., G. W. HOPPLE, and P. J. ROSSA (1979) "Sociopolitical Indicators of Conflict and Cooperation," pp. 64-86 in J. D. Singer and M. D. Wallace (eds.) To Augur Well. Beverly Hills, CA: Sage.

WILKENFELD, J., G. W. HOPPLE, S. J. ANDRIOLE, and R. N. McCAULEY (1978) "Profiling States for Foreign Policy Analysis." Comparative Political Studies 11 (April): 4-35.

WILKENFELD, J., V. L. LUSSIER, and D. TAHTINEN (1972) "Conflict Interactions in the Middle East, 1949-1967." Journal of Conflict Resolution 16 (June): 135-154.

WITTMEYER, J. F. (1976) Software Design for an Interactive Crisis Early Warning Phototype System. Technical Report 76-20, December. McLean, VA: Decisions and Designs, Inc.

ZIMMERMAN, W. (1973) "Issue Area and Foreign-Policy Process: A Research Note in Search of a General Theory." American Political Science Review 67 (December): 1204-1212.

ZINNES, D. A. and J. WILKENFELD (1971) "An Analysis of Foreign Conflict Behavior of Nations," in W. F. Hanrieder (ed.) Comparative Foreign Policy. New York: McKay.

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Research on the international Early Warning and Monitoring System (EWAMS) and the intranational Africa Warning and Monitoring System (AWAMS) is the subject of this report. Recent political indicator analysis and testing and software development and refinement activities have been extensive in scope and magnitude. The master version of the EWAMS has been fully developed and is being tested and enhanced.

A key objective of recent research has been the realm of crisis warning.

The discriminant analysis methodology was tested extensively and has been incorporated into the system. The accuracy and efficiency of the methodology led to a decision to replace the simple extrapolative warning methodology with one based on discriminant function-generated probabilities.

The prototype Africa system reflects extensive basic research on monitoring intranational affairs. The current version of the AWAMS features an empirical data base (from several sources), political indicators, and a computer base. Thus far, the conceptual blueprint has been completed; the data collection design has been developed for intranational events, subnational actors and targets, and other elements of the AWAMS. In addition, the software base of the prototype AWAMS has been designed and programmed.

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